SERVICE MANUAL

L SERIES

HO-735

HAMMOND ORGAN COMPANY
DIVISION OF HAMMOND CORPORATION
11700 Copenhagen Court / Franklin Park, Illinois 60131
(312) 766 - 6950

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INTRODUCTION

This manual contains service information for L–100 Series organs. The series is comprised of the following models:

L–100
L–100A
L–100–1
L–100–2
L–200

The Model L–100 Hammond organ is a completely self-contained console, requiring no external tone cabinet. It has two manuals or keyboards of 44 keys each, a 13 note pedal keyboard, and an expression (swell) pedal for controlling the volume. All tones are produced by electro-magnetic tone generators and electrically amplified. Selection of tone colors is made by adjusting 17 drawbars and 6 preset tabs. Other characteristics of the music are adjusted by means of 10 other tabs. A toggle switch, located to the right of the console above the manuals, is used to turn on the organ. A pilot light shows when the organ is turned on.

Model L–100A is similar to Model L–100, with the addition of percussion voicing circuitry, controlled from the lower left end block.

Model L–100–1 is similar to L–100, with a six-voice percussion feature added. Percussion controls are mounted in the lower right end block.

Model L–100–2 is identical to Model L–100–1, with the addition of the "drawer" type automatic Rhythm II feature. No service information for Rhythm II is contained in this manual, since its circuitry is independent of the organ. For Rhythm II service information, refer to the Service Manual for Rhythm II, HO–466.

Model L–200 with inbuilt rhythm is electrically identical to the L–100–2 organ. Wiring of the rhythm uni to the console is presented in Figure 5–20.

L–Series organs will have fuses added to the Canadian power supply (101–000130) to comply with C.S.A. standards. Location and value of fuses are shown in Figure 5–19.

For convenience in location desired information, this manual is divided into the following sections:

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I. How the Organ Operates
II. Theory of Operation
III. Disassembly
IV. Practical Service Suggestions
V. Diagrams
VI. Parts List

SPECIFICATIONS

DIMENSIONS: Width, 43½"; Height, 44½"; Depth, 23"
WEIGHT: 215 lbs.
POWER INPUT: 140 Watts
OUTPUT: 15 Watts, E.I.A.

SECTION I
HOW THE ORGAN OPERATES

1–1. **GENERAL** – This section contains a description of the operating principles of L–100 Series organs. Figures 1–1 and 1–2 depict the locations of the various subassemblies. Figure 1–3 is a block diagram.

1–2. **TONE SOURCE** – Most tone sources, such as strings, reeds, or pipes, produce complex tones. The Hammond tone-producing mechanism, however, generates individual frequencies which can be combined by means of harmonic drawbars to produce any desired tone quality. The block diagram, Figure 1–3, shows the chief components of the instrument.

Electrical impulses of various frequencies are produced in the "tone generator assembly" which contains a number of "tone wheels" driven at predetermined speeds by a motor and gear arrangement. Each tone wheel is a steel disc similar to a gear, with high and low spots, or teeth, on its edge (see Figure 1–4). As the wheel rotates, these teeth pass near a permanent magnet, and the resulting variations in the magnetic field induce a voltage in a coil

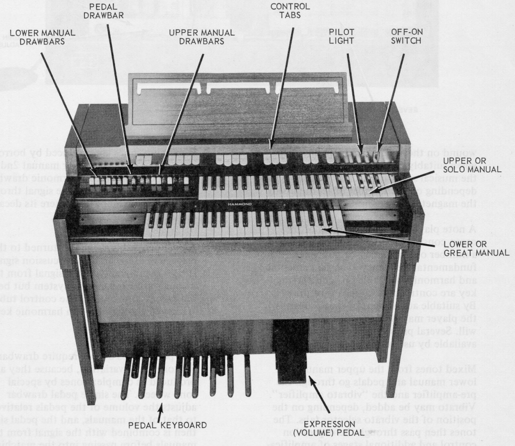


Figure 1–1. L-100 Console, Front View

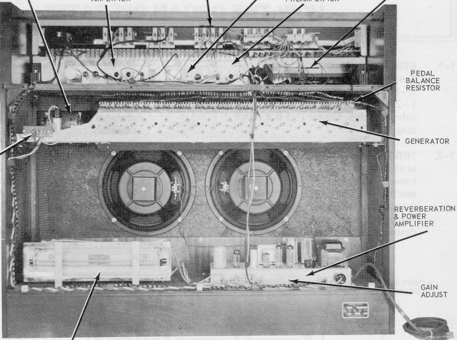


Figure 1–2. L-100 Console, Rear View

wound on the magnet. This small voltage, when suitably filtered, produces one note of the musical scale, its pitch or frequency depending on the number of teeth passing the magnet each second.

A note played on either manual of the organ consists of a fundamental pitch and a number of harmonics, or multiples of the fundamental frequency. The fundamental and harmonics available on each playing key are controllable by means of drawbars. By suitable adjustment of these controls the player may vary the tone colors at will. Several pre-selected tones are also available by use of the preset tabs.

Mixed tones from the upper manual and lower manual and pedals go through the pre-amplifier and the "vibrato amplifier". Vibrato may be added, depending on the position of the vibrato selector tabs. The tones then pass through the expression control and additional stages of amplification before reaching the speaker.

Percussion tones are produced by borrowing a signal from the upper manual 2nd harmonic drawbar, 3rd harmonic drawbar, or both, and conducting the signal through the percussion amplifier, where its decay characteristics are controlled.

A portion of this signal is returned to the respective drawbar. The percussion signal is then combined with the signal from the manuals after the vibrato system but before the expression control. The control tubes are keyed through the 6th harmonic key contacts and busbar.

The pedal tones do not require drawbars for tone color variation, because they are produced as complex tones by special tone wheels. The single pedal drawbar adjusts the volume of the pedals relative to that of the manuals, and the pedal signal then is combined with the signal from the manuals before passing into the matching transformer.

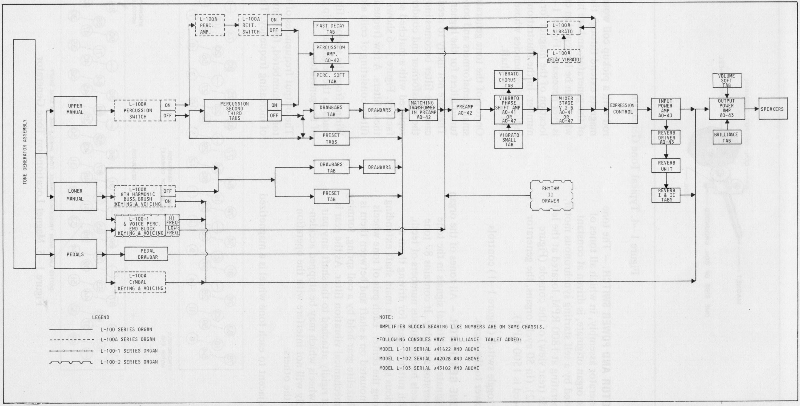


Figure 1–3. Block Diagram, L-100 Series

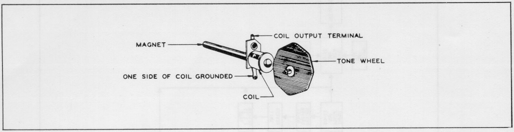


Figure 1–4. Typical Tone Generator

1–3. **MOTOR AND POWER SWITCH.** – The tone generator assembly, in which all tones of the organ originate, is driven at constant speed by a self starting synchronous motor, operating at 1800 RPM, located at the left side (rear view) of the console (Figure 1–2). (In 50 cycle organs, the generator speed is 1500 RPM).

A toggle switch (Figure 1–1) controls power to the organ.

1–4. **TONE GENERATOR.** – All tones of the organ originate as electrical signals in the tone generator assembly. It contains 87 tone wheels having various numbers of teeth, with suitable gears for driving them at various speeds from a main shaft extending along the center. Each pair of tone wheels is mounted on a shaft and between them is a bakelite gear held by a coil spring, forming a mechanical vibration filter. As the gear is not rigidly attached to the shaft, any pair of wheels which may be stopped accidentally will not interfere with the operation of the others.

Adjacent to each tone wheel is a magnetized rod with a pickup coil wound on it. These magnets extend through the front and back of the generator, and are held by set screws which can be loosened in case adjustment is ever necessary. Figure 1–5 shows the location of the magnet for any frequency number. In the illustration the dotted lines indicate frequencies whose tone wheels are on the same shaft.

On top of the tone generator assembly are small transformers and condensers, forming tuned filters for the higher frequencies. They are not likely to need replacing. In case one filter becomes inoperative, both the transformer and condenser must be replaced with a matched set from the factory. Figure 1–6 shows the location of these filters. A few frequencies use untuned filters consisting of coils alone.

Wiring from the various filter assemblies leads to the terminal strip on the long edge of the generator.

The output frequencies of the tone generator are numbered, for convenience, in order of increasing frequency. The lowest, number

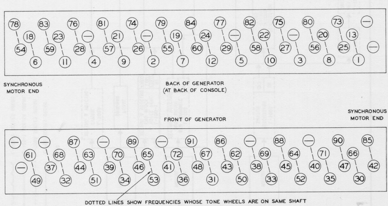


Figure 1–5. Magnet Locations on Tone Generator

1, is about 32 cycles per second, and the highest, number 91, is about 6000 cycles per second. Frequency numbers 1 to 13 are used only for the pedals; numbers 14 to 17 are omitted; and numbers 18 to 91 are used for the manuals. Figure 1–6 showing filter locations also shows the termination point of each frequency, while Figure 5–1 shows typical tuned and untuned tone generators.

In case any generator frequency is weak or absent, refer to "Practical Service Suggestions" for the procedure to be used in locating and correcting the trouble.

1–5. MANUALS. – Musical frequencies from the tone generator go through the manual cable to terminal strips on the two manuals and from them to the key contact springs.

Each of the two manuals has 44 playing keys, or approximately 3½ octaves. The two manuals do not cover exactly the same pitch range, but they are arranged so that keys of like pitch are in line. Middle "C" is the first C on the upper manual and the key in line with it on the lower manual.

Under each key are a number of contact springs (for the fundamental and harmonics of that key) which contact an equal number of busbars when the key is pressed. All contact springs and busbars have precious metal contact surfaces to avoid corrosion, and the manuals are sealed to exclude dust so far as possible. In case a contact becomes dirty in spite of these precautions, a busbar shifter is provided in each manual to slide the busbars endwise and thus provide a fresh contact surface. (See paragraph 4–3b).

Looking under the lower manual on the left hand end (front view) a black wood end block will be observed. One half inch from the front of this block is a drilled hole. Within this drilling is a small metal tongue with a punched hole. Using either long nose pliers or a hook, this tongue can be moved in and out and it in turn moves the busbars. The upper manual shifter is in a similar place and access to it is from the rear of the console.

The key contacts are connected through resistance wires to the manual terminal strips. The manual wiring chart, Figure 1–7, shows how the contacts of each key are connected to the proper frequencies to supply the fundamental and harmonics of that particular key. The blank spaces indicate that no key contact is used, inasmuch as the higher harmonics of these keys are not required. Since the percussion control circuit is keyed through the 6th harmonic busbar, the blank spaces in this row have contacts connected to ground through resistance wires.

The busbars of each manual, each one carrying a certain harmonic, are wired to the appropriate harmonic drawbars for that manual through the "Drawbars" tab.

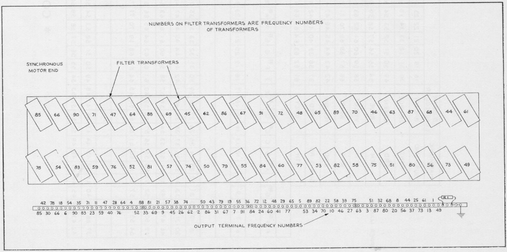


Figure 1–6. Filter Locations and Frequency Terminations on Generator Cover

		KEY NUMBERS	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61
		NOTES	F	F#	G	G#	A	A#	B	C	C#	D	D#	E	F	F#	G	G#	A	A#	B	C	C#	D	D#	E	F	F#	G	G#	A	A#	B	C	C#	D	D#	E	F	F#	G	G#	A	A#	B	C	C#	D	D#	E	F	F#	G	G#	A	A#	B	C
UPPER MANUAL	HARMONIC	BUSBAR LEAD COLOR													FREQUENCY NUMBERS																																													
UPPER MANUAL	SUB-FUND	BROWN													18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61
UPPER MANUAL	FUND	ORANGE													30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73
UPPER MANUAL	3RD	GREEN													49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	
UPPER MANUAL	4TH	BLUE													54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91						
UPPER MANUAL	5TH	VIOLET													58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91										
UPPER MANUAL	8TH	WHITE													66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91																		
UPPER MANUAL	2ND	YELLOW													42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
UPPER MANUAL	SUB-3 RD	RED													37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
UPPER MANUAL	6TH	GREY													61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	*	*	*	*	*	*	*	*	*	*	*	*	*
LOWER MANUAL	HARMONIC	BUSBAR LEAD COLOR	FREQUENCY NUMBERS																																																						
LOWER MANUAL	FUND	BROWN	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61												
LOWER MANUAL	2ND	RED	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73												
LOWER MANUAL	5TH	GREEN	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89												
LOWER MANUAL	6TH	BLUE	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91													
LOWER MANUAL	8TH	VIOLET	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91																		
LOWER MANUAL	3RD	ORANGE	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80												
LOWER MANUAL	4TH	YELLOW	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85												

* CONTACTS GROUNDED THROUGH 16 OHMS

Figure 1–7. Manual Wiring Chart

1–6. HARMONIC DRAWBARS. – The left group of seven harmonic drawbars (Figure 1–8) is associated with the lower manual, and the right group of nine drawbars controls the upper manual. By sliding these drawbars in and out, the organist is able to mix the fundamental and harmonics (or overtones) in various proportions. The distance a bar is pulled out determines the strength of the corresponding harmonic; and if a drawbar is set all the way in, the harmonic it represents is not present in the mixture. Neither manual will play unless one of its drawbars is pulled out at least part of the way with the drawbar tab pressed, or a preset tab is pressed.

The drawbars slide over 17 busbars, representing intensity levels. As the drawbar moves, its contact is touching some busbar at all times, and therefore there is a smooth change in volume of that harmonic.

These busbars extend the length of the drawbar assembly, and are connected to the low impedance primary of a matching transformer. Signals from the high impedance secondary of this transformer go to the preamplifier input. The matching transformer is located within the preamplifier chassis.

1–7. PEDAL DRAWBAR. – The center drawbar adjusts the volume of the pedals. Its operation is similar to that of a manual drawbar.

1–8. PEDAL KEYBOARD. – The 13 playing pedals are operated by the left foot and are connected to the lowest 13 frequencies of the generator. Like the manuals, they have light and dark keys arranged in the standard octave pattern. Figure 1–9 identifies the pedals and shows the generator frequency number associated with each. A single contact on each pedal closes when the pedal is pressed, thereby allowing the correct generator frequency to reach the amplifier.

1–9. EXPRESSION PEDAL. – The expression pedal, sometimes called "swell" pedal (Figure 1–1) is operated by the player's right foot and varies the volume of both manuals and pedals together. When the pedal is tilted back (closed) by pushing on the player's heel the music is softest, and when pushed forward (opened) by the player's toe the music is loudest.

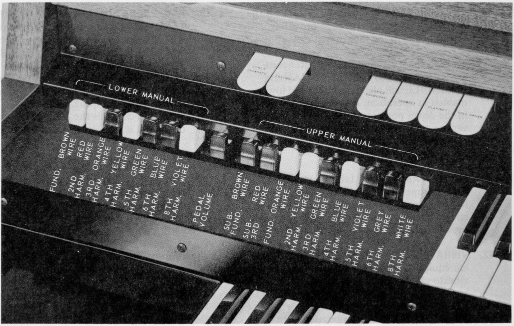


Figure 1–8. Drawbars & Control Tabs (Partial View)

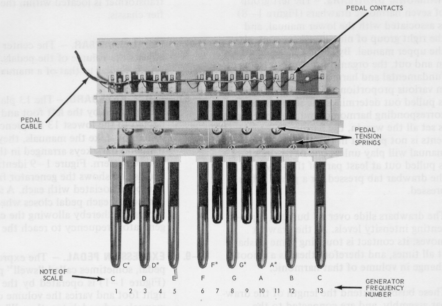


Figure 1–9. Pedal Keyboard

1–10. CONTROL TABS. – There are 17 tabs on the L-100 series instrument, each providing some change in the instrument's operation.

To have the instrument sound after turning it on, tabs such as FULL ORGAN and ENSEMBLE will place the upper and lower manual in operation. A tab is in use when in the down position. Functions of the various tabs from left to right as they appear on the instrument are given in the following paragraphs.

1–11. PRESET TABS. – Four tabs are provided for the upper manual and two for the lower manual. As indicated, they provide a choice of using the drawbars or playing the preset tones indicated on them.

1–12. VIBRATO TABS. – The L–100 series organs are equipped with 3 tabs which vary the vibrato effect. Three degrees of vibrato are available using the VIBRATO NORMAL, VIBRATO SMALL or both together. VIBRATO CHORUS can be used with VIBRATO NORMAL, VIBRATO SMALL, or both, to provide different degrees of chorus.

1–13. REVERBERATION AND VOLUME SOFT TABS. – Several degrees of reverberation are obtained by the use of either or both tabs labeled REVERB I and REVERB II. These tabs, in addition to turning this feature on, govern the loudness or amount of reverberation by a resistive network used in conjuntion with the speaker. The VOLUME SOFT tab controls the overall volume of the organ and is especially useful where playing

1–14. PERCUSSION CONTROL TABS – There are four of these tabs which operate only when the upper manual DRAWBARS tab is depressed. Pressing either the SECOND HARMONIC or THIRD HARMONIC tab will, when the upper manual is played, cause the tone to sound percussively (in addition to sustained organ tones). Both tabs can be depressed, giving a combination percussive tone. The FAST DECAY tab causes the percussive tones to fade away with greater rapidity. PERCUSSION SOFT reduces the volume for the percussive signal. Operation of the electrical circuits associated with this feature is described in subsequent paragraphs.

1–15. L–100A PRESET PERCUSSION UNIT (See Figure 1–10). – When added to the L–100 series instrument, this unit adds five pre-voice percussion effects, including reiteration in three speeds. It also provides three percussion effects, "Normal (Non-Vibrato)", "Vibrato", and "Delayed Vibrato". For the rhythm accompaniment it also provides a "Cymbal-Brush" effect, the "Brush" being on the lower manual, and available when played in a legato fashion each time a key is depressed. The "Cymbal" is available on the pedal and sounds each time a pedal is depressed. The "Cymbal-Brush" control turns these effects on and selects the "Cymbal-Brush" volume.

1–16. SELECTOR SWITCH. – With the Selector Switch in the "Drawbar" position, the signals from the upper manual harmonic busbars are routed to their associated drawbars in the upper manual group. The following is a breakdown of the harmonic switching used.

1–17. HARMONIC BUSBAR SWITCHING AND REITERATION SPLIT. – Upper Manual. The Sub-Fundamental, sub-third and eighth harmonics are not switched. The sixth harmonic busbar is used for percussion keying.

With the Selector Switch in the "Drawbar" position, all harmonic busbars are routed to their associated drawbars.

1–18. L–100–1 SIX-VOICE PERCUSSION FEATURE (See Figure 1–11). –

1–19. LOCATION OF CONTROLS. – The rhythm controls are located on the right end block of the lower manual.

1–20. VOICING. – The following voices are available.

BLOCK
CYMBAL
BRUSH
BONGO
TOM-TOM
CLAVES

1–21. OPERATION OF CONTROLS. – Any of the six voices may be played at any time by means of the momentary push buttons associated with the rocker tabs.

The BLOCK and CYMBAL voices are programmed into the pedal keyboard when their rocker tabs are "on". The remaining four voices are programmed into the lower manual keys when their rocker tabs are "on".

REITERATION SPLIT

	"A" CHANNEL	"B" CHANNEL	DRAWBARS
Chime	2nd 3rd 4th (5th to Freq. Div.) (1-1/4 From Freq. Div.)		Fundamental
Guitar	Fundamental 3rd 4th 5th		2nd
Marimba	Fundamental	2nd	3rd 4th 5th
Xylophone	Fundamental	3rd	2nd 4th 5th
Banjo	2nd 3rd 4th 5th		Fundamental

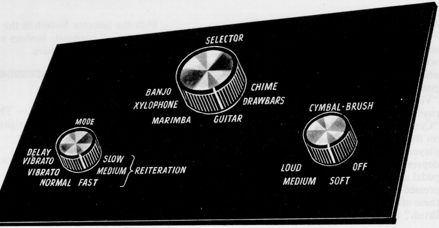


Figure 1–10. L-100A Preset Percussion Unit

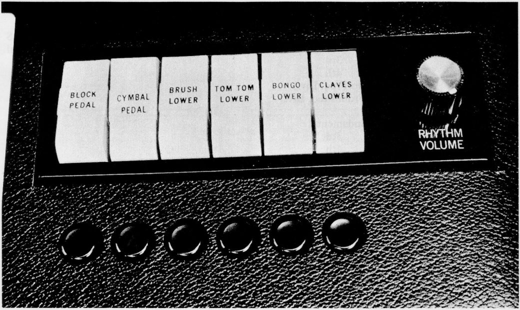


Figure 1–11. L-100-1 Six-Voice Percussion Controls

The RHYTHM VOLUME control, mounted to the right of the rocker tabs, regulates the loudness of the rhythm voices relative to the other organ voices. The organ's expression pedal also affects the rhythm voices except brush and cymbal.

The BRUSH and CYMBAL voices sound without reverberation. The remaining voices are reverberated whenever a REVERB tab on the organ's control panel is depressed.

1–22. EXTERNAL EQUIPMENT. – The L–100 Series organs may be equipped with extension speakers, external inputs and earphones.

1–23. EXTENSION SPEAKERS. – A Hammond Model PR–40 Tone Cabinet may be used as an extension speaker. A Tone Cabinet Control Kit, P/N AO–22625–2 is required for proper interconnections. Installation instructions are furnished with the kit.

1–24. EXTERNAL SOUND SOURCE. – A record player or microphone equipped with a suitable preamplifier, or a radio, can be played through the organ's speakers. The device used should have an output level of about 1/2 volt rms maximum, and should have its own volume control, since the organ volume controls will not affect the signal. The organ may be played at the same time.

To connect an external sound source, a Switchcraft Type 330 Fl "Y" connector is required. Remove the connector cable from the WH terminal on the power amplifier. Insert the "Y" connector into the terminal, and insert cable previously removed into one arm of the "Y". Connect external sound source to the other arm.

1–25. EARPHONES. – In order to use earphones, the output jack and network shown in Figure 1–12 are required. When earphones are in use, organ speakers are silenced.

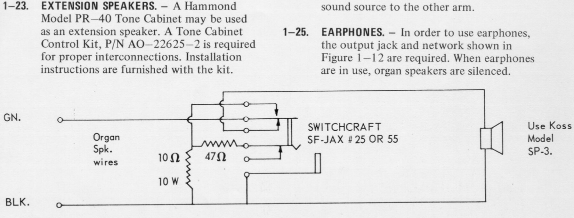


Figure 1–12. Earphone Adapter Circuit

SECTION II
THEORY OF OPERATION

2–1. **GENERAL.** – This section contains circuit descriptions of the amplifier chassis, and the percussion attachments. There are three amplifier assemblies in the L–100 series instruments. On the upper shelf as viewed from the rear, to the left is the vibrato amplifier, towards the center the preamplifier and percussion amplifier, while the reverberation and power amplifier is located on the lower shelf.

2–2. **PREAMPLIFIERS (See Figure 5–1).** – The preamplifier (V1) receives all signals impressed on the matching transformer secondary, which originate by use of the drawbars or preset tabs. Should any percussion tab be in use, portion of the second, third or both harmonics of the upper manual will also appear in the input circuit of the percussion amplifier which will be discussed further on.

2–3. **VIBRATO PHASE SHIFT AMPLIFIER (See Figures 5–1 through 5–4).** – The vibrator system varies the frequency of the tones by continuously shifting their phase. Circuit components include three series-connected vacuum tube phase shifter stages (V2A, V2B, and V3A), associated saturable reactors (SR101, SR102, SR103), voltage amplifier (V3A), vibrato oscillator (V4A), and driver stages (V4B, V5).

A single low frequency oscillator (V4) provides the rate for the vibrato system (approx. 6.8 CPS). With either the normal or small vibrato tab in use, this oscillator impresses its signal on V4, a cathode follower and isolation stage. Positive pulses now appear on the grid of driver tube V5. The plate circuit of this tube is in series with three saturable reactors located in the plate and cathode circuits of the phase shift stages. Irrespective of which vibrato stop is used, the rate remains constant, but the degree of vibrato is determined by the amplitude of the positive pulse on the driver tube.

The continuous phase shift is accomplished by using 180° out-of-phase signals from the plate and cathode of each shifter stage and controlling them with the saturable reactors. Plate and cathode resistors are of equal value and consequently signals are equal in amplitude in each plate and cathode circuit. The saturable reactors serve as a means of providing a varying composite of signals from both plate and cathode of each stage, ranging from virtually full cathode signal to full plate signal.

The driver tube plate current varies from about .5ma to 5ma. at vibrato rate. This current varies the degree of saturation in the reactor cores and results in a smoothly varying impedance.

At minimum driver current (when the voltage feeding driver tube V5 is negative and driver tube is nearly cut off) the reactor impedances are maximum and are large compared to the 15000 ohm plate. circuit series resistors R104, R110, R115.

Therefore, under this condition most signal will emanate from the plate. (The reactors being virtually short circuited by the plate circuit series resistors) and phase shift will be maximum – approaching 180° – since plate voltage is 180° out of phase with grid voltage.

At maximum driver current (when voltage feeding driver tube V5 is positive and driver tube is conducting maximum current) the reactors are saturated and their impedance is a minimum –small compared to the 15000 ohm plate circuit series resistors R104, R110, R115. Therefore, most signal will emanate from the cathode (the saturated and low impedance reactors virtually short circuit the plate circuit series resistors) and phase shift will be a minimum – approaching 0° – since cathode voltage is in phase with input grid voltage.

Between these extremes, the phase varies smoothly under control of the saturable reactors.

The continuous change in phase is equi-

valent to a continuous frequency variation, and thus the frequency varies up and down at vibrato rate.

PERCUSSION AMPLIFIER (See Figures 5–1 through 5–4). – The 2nd or 3rd harmonic signal, or both, when these tabs are depressed, will be impressed upon the input of the 2N306 transistor. The output of this transistor is resistance coupled to the one half of V11 which acts as a control tube and is normally conducting, so when a key is depressed the percussive note first sounds loudly. It passes through the control tube and a band pass filter and is impressed on the grid terminal of V1.

Immediately the note begins to fade away, giving the characteristic percussion effect. This fading is accomplished as follows: When either harmonic stop is depressed the keying wire (normally held at plus 28 volts through anti-spark resistor R215) is connected to solo manual 6th harmonic drawbar. When a key is pressed this keying line is grounded through the key contact and tone generator filter. This virtually grounds the grid and plate of V11 (connected as a diode) open-circuiting the tube and isolating the control tube grid circuit. The grid of the control tube drifts from its operating potential of about 25 volts to a cutoff potential potential (about plus 15 volts) at a rate determined by the time required for C210 to discharge through R219 and R409.

The percussion signal is now blocked. No percussion notes can sound until all keys of the solo manual are released and the control grid again rises to plus 25 volts. The time of this rise (that is, how quickly the control tubes turn on again after the key is released) is the time required to charge C210 to plus 25 volts through R218.

When a "percussion" tab is pressed the solo manual second, third, or both harmonic manual busbars are connected to the green percussion signal line and a 5 OHM series resistor is connected between the manual bus wire and drawbars providing for a sustained signal in addition to the percussion signal. The 6th harmonic drawbar is disconnected from its lead wire and this wire (which is grounded through the generator magnets when any key is pressed) is used to turn off the control tube. Therefore the 6th harmonic is not available on the upper manual when the percussion is in use.

When the PERCUSSION SOFT tab is down, it reduces the volume by shunting resistor R224 into the dividing network composed of R222 and R223.

The PERCUSSION FAST DECAY tab determines how fast the sound fades away after a key is pressed. When the tab is up, resistor R219 discharges capacitor C210, reducing the D.C. voltage on the control tube grids to cut-off in about 2-1/2 seconds. When the tab is down, resistor R409 is shunted across resistor R219, reducing the time to discharge capacitor C210 and thereby reducing the D.C. voltage on the control tube grid to cut off in less than one-half second.

With either or both 2ND and 3RD HARMONIC tabs down, the harmonic drawbar wires are connected to the green signal input wire of the percussion amplifier. Either or both signals are fed back to their respective drawbars by resistors R410 and R411 which are shorted out when the percussion tabs are not in use.

The percussion signals as well as the signals from the vibrato and phase shift amplifier are combined in the input circuit of cathode follower V1 and are sent to the expression control, which is also connected to the input of the reverberation and power amplifier.

2–5. REVERBERATION AND POWER AMPLIFIER (See Figure 5–4). – The combined signals from both prior mentioned amplifiers (after the expression control has acted upon them) are impressed on the grid of V6 and in turn on V7, the reverberation drive tube. After passing through the reverberation unit the signal is again amplified by V6 and passed through a resistive network, components of which are variable, permitting the reverberation to be available in several intensities and "off". From the input of V7 (the reverberation drive tube) a signal is shunted around the reverberation unit and its control features which provide a path for the non-reverberation signal. The input of V8 receives this signal as well as a reverberative signal. This common input line also contains the VOLUME SOFT tab circuitry.

The output of the second half of V8 is a

phase inverter driving push-pull output tubes V9 and V10. A feedback circuit from the output transformer secondary (R336 and R337) makes the pedal response more uniform by reducing speaker resonance. R336 is adjusted at the factory.

2–6. POWER SUPPLY (See Figure 5–4). – The power supply uses a 5U4 rectifier tube with conventional filtering circuit.

2–7. L–100A PERCUSSION VOICING CIRCUITRY (See Figure 5–5).

2–8. MODE SWITCH – With the "Mode Switch" in any of the reiteration positions, the harmonics necessary to produce the "Chime", "Guitar", and "Banjo" are all fed into the "A" reiteration channel only, while the "Marimba" and "Xylophone" effects feed harmonics into both the "A" and the "B" channels. This split into the "A" and "B" channels only occurs with the use of reiteration. Without reiteration, all effects are routed into the regular percussion system. The two reiteration channels are identical. You will note that across the secondary windings of the two input transformers is located a field-effect transistor. These gates Q300 and Q303, are fed alternating pulses from a bistable multivibrator which supplies alternate pulses to each one of these gates. That is; one is on, while the other is off. These gates shunt the signal to ground, thereby making the channel inoperative. These individual signals are further amplified by a one stage transistor amplifier, Q301 for the "A" channel, and Q302 for the "B" channel. They are then mixed together and fed to a common amplifier, Q307, which in turn feeds this percussion signal to the input side of the swell pedal. The multivibrator which supplies the keying pulse for these two gates does not run continually, but rather is turned off and on each time a key is depressed on the upper manual. The multivibrator consists of Q305 and Q306. The multivibrator rate varies with the applied base voltage. This voltage is applied through the "Mode Switch" and R684 and R685. Q304 provides the necessary switch pulse to start the multivibrator.

NOTE

Whenever the reiteration is used, it completely bypasses the percussion section of the A0–42 amplifier.

With the "Mode Switch" in the "Normal", "Vibrato", or "Delayed Vibrato" position, the various pre-voiced percussions are routed to a percussion preamplifier made up of Q314 and Q313. These amplified signals are then routed into the regular Hammond percussion system at the collector of Q201. With the "Mode Switch" in the "Normal" position all percussion voices sound as normal; that is, they have no vibrato.

NOTE

To obtain the following vibrato effects it will be necessary to depress one or both of the VIBRATO tabs.

With the "Mode Switch" in the "Vibrato" position, a portion of the percussion signal is taken from the input side of the Expression pedal and routed through R670, the "Mode Switch", and is then fed to the grid of V1 A (Pin 2). Here the percussion voices are amplified and fed to the vibrato phase shift amplifier. All voices so routed now appear with vibrato.

With the "Mode Switch" in the "Delayed Vibrato" position, a portion of the percussion signal is taken from the input side of the Expression pedal, and routed to a voltage divider made up of R682 and R681. This weak signal is fed to the base of Q312. It will be noted that the emitter of this stage is not bypassed and that the output of this stage is relatively low. During keying, after a predetermined time lag (.5 seconds), the charge on C631 is depleted by Q308 and Q309. With this charge depleted, Q308 and Q309 stop conducting and their respective collectors assume the supply potential +12V. This +12V. from the collector of Q309 is now applied to the base Q310, thereby placing Q310 and Q311 in a state of conduction. With Q311 now conducting, C633 is placed across the emitter resistor of Q312. This materially increases the gain of this stage, and as the percussion is dying away, feeds this amplified portion of the fading percussion signal through the "Mode Switch", and R683 to the grid of V1 A (Pin 2). There the signal is amplified and fed to the Vibrato Phase-Shift amplifier. All voices so routed now appear with a vibrato tail-off.

Two positions of the "Mode Switch", "Vibrato", and "Delayed Vibrato" also effect the normal Hammond percussions when they are in use (See Note above).

2–9. FREQUENCY DIVIDER – When using the "Chime" voice, it is necessary to create a 1-1/4 harmonic for the proper reproduction of the "Chime" tone. This is accomplished by routing the 5th harmonic into an amplifier made up of Q315 and Q316. Q317 rectifies and further amplifies this pulse which is then fed to a two-stage frequency divider, made up of Q318, Q319, Q320, and Q321. The output of this second frequency divider is then routed back to the "Selector Switch", and is used as one of the harmonics in the "Chime" voice.

NOTE

Because a frequency divider can handle only one frequency at a time, any attempt to play two or more "Chime" notes at a time will result in distortion.

2–10. CYMBAL AND BRUSH – The "Cymbal-Brush" switch when in the "off" position disables the keying functions necessary to produce the "Brush" effect. With the "Cymbal-Brush" switch in any one of the "on" positions, the 8th harmonic of the lower manual is disabled and this harmonic busbar is used for keying the "Brush" effect. The pedal signal (keying) contact is used to activate the "Cymbal" effect each time a pedal is depressed.

2–11. BRUSH KEYING – With the "Cymbal-Brush" switch in any of the ON positions, the base of Q322 is routed now to the 8th harmonic busbar in the lower manual. Anytime a key is depressed, the base voltage of this transistor is routed to ground, and this stage stops conducting. The attendant rise in collector voltage is impressed on one plate of C608. The other plate of C608 responds by driving excess electrons off to ground through resistor R624. The resultant positive voltage is then fed through D203 to the base of Q323, the "Brush" gate. To the base of this "Brush" gate is also fed the noise from the noise generator Q324. This noise is now tuned in the collector circuit and fed to the "Cymbal and Brush" amplifier which consists of Q325 and Q326.

2–12. CYMBAL KEYING. – Anytime a pedal is depressed, the pedal signal is routed to the pedal drawbar. A portion of this same signal is also fed to Q327 and Q328. These stages amplify and shape the signal and feed it through R612 to the base of Q330, and through R613 and D205 to a R/C storage network and the base of Q329. The signal developed across R616, the emitter resistor of Q330, is rectified by D204 and this positive voltage is applied to the base of Q331, the "Cymbal" gate, turning it on. At the same time, the output of Q328 is being rectified by D205 and slowly applied to the base of Q329. When Q329 is biased into conduction it depletes the base bias normally supplied to Q330 through R612 and Q330 stops conducting. In this state, no signal is available at the emitter of Q330 to be rectified, and Q331, the "Cymbal" gate, slowly turns off. To the base of this "Cymbal" gate is also fed the noise from the noise generator, Q324. This noise is tuned in the collector circuit of Q331 and fed to Q325 and Q326 the "Cymbal and Brush" amplifier.

2–13. BRUSH AND CYMBAL AMPLIFICATION. – After being amplified by Q325 and Q326, the "Brush and Cymbal" signals are routed to a voltage divider consisting of R604, R605, and R606. It is then tapped by the switch and routed to R602 the overall level control. This is located on a terminal strip on the lower organ shelf, near the A0–43 amplifier. The wiper of the overall level control (R602) now feeds into the A0–43 amplifier through R601 and C318 to Pin 7 of V8. To enhance the "Brush and Cymbal" effects, a small high frequency speaker is attached to the main amplifier. It is located under the lower right hand end block on the organ.

2–14. POWER SUPPLY. – Power supply chassis is supplied with +340 volts DC from A0–43 amplifier. +80 volts required for percussion assembly is obtained from voltage divider R690, and R691. +12 volts is obtained from Zener Diode D201.

2–15. L–100–1 SIX-VOICE PERCUSSION CIRCUITRY. –

2–16. POWER SUPPLY (See Figure 5–7). – Power supply components are located in the power supply chassis assembly (127–7

thru –9). All necessary DC supply voltages for the rhythm unit are supplied by this chassis. The output voltages are 30 V DC, 15 V DC, and 5.5 V DC. The 5.5 V output is not used in the Model L–100–1 organ.

120 V AC 50/60 Hz is supplied to the power transformer from an external source. The secondary AC voltage is 40 V AC, which is then rectified by the full wave bridge of diodes D100, D101, D102 and D103. This DC voltage is then filtered by the combination of R101, R103, C100A, C101 and applied across the 30 V DC Zener diode D104. The 30 V DC is the supply voltage for the amplifier stages Q106, Q107 and Q108 on the rhythm PWB and the reference voltage for the 15 V DC and 5.5 V DC supplies. The 30 V DC is supplied to the voltage divider of R107 & R108 and fed to the voltage regulators Q100 & Q102, the output of which is the 15 V DC which is used to supply all other circuits on the rhythm device.

The 30 V DC is also supplied to the voltage divider R106 & R105, and fed to the emitter follower Q101, the emitter output of which is 5.5 V DC. Q101 is used as a voltage regulator and in conjunction with C100B provides the filtering for the 5.5 V DC.

2–17. PUSH BUTTON CIRCUITS (See Figure 5–6). One side of each push button is connected thru R200, 2.2K ohm resistor to the 15 V DC supply. The 15 V DC is available to the push buttons at all times, and if one is depressed at any time, that particular voice will appear at the output. When any of the push buttons is depressed, that button applies 15 V DC to the base input of a phase shift oscillator.

As an example, if the BLOCK push button is depressed, 15 V DC is applied to the junction of R100B and capacitor C100B. This signal is differentiated by C100B and the resulting pulse is fed thru D100B and R105 to the base of Q100B, turning it on. This signal is fed back to the base, inverted by the phase shift network C103B, C102B, C104B, R106B, and R107B, and will be regenerative for a period of time determined by R100B, C100B, and R101B. The decay-time of the collector output depends upon the values of C101B, R105B and R102B. The output is coupled through capacitor C105B, resistor R104B, and capacitor C120 to the base of amplifier stage Q107, and after amplification by Q107 and Q108, it is connected to R203, the volume control. TOM-TOM, BONGO, and CLAVES are similar in operation. The frequencies of the oscillators are determined by the values of the components in the phase shift network.

When the BRUSH push button is depressed, +15 V DC is supplied to the junction of R116 and C111, and this supplies bias through D102 to the base of Q103, turning "on" the one shot multi-vibrator stage, Q103 and Q104 for one complete cycle. The Brush Gate transistor Q105 is turned "on" for a period determined by C113 and R120 of the multi-vibrator stage. This applies positive bias through R123, D104, R124 to base of Q105, turning on Q105 and allowing white noise to appear on collector of Q105, tuned by C115 and L101, and this signal is then routed through C117 and output level control R126 and R127 to hiss amplifier Q106.

2–18. LOWER MANUAL KEYING CIRCUITS (See Figure 5–6). – The lower manual buss line is connected through C124 and the base of Q109, which is a pulse amplifier stage. Resistor R147 provides base bias to the stage, so that with no key depressed, the collector is at approximately 4.5 V DC. C124 and R145 is a differentiating network which puts a pulse on the base of Q109. This pulse is amplified by Q109, and instantaneously the collector of Q109 rises from 4.5 V DC to approximately 11 V DC. This change is routed through R149 to the base of Q110, which at an emitter voltage of 5.5 V and base bias of 4.5 V was "off". With 11 V on its base, Q110 turns "on", and its collector, which was at 15 V drops to 5.5 V. This change is coupled through C126 and R153 to the base of Q111, a PNP which has been biased "off" through R152 and R153. The change in bias turns "on" Q111 and the collector has an instantaneous output of +15 V DC of about 2 milliseconds duration. This trigger pulse is defined as the <u>lower manual trigger pulse.</u> The pulse is routed through whichever LOWER tabs are "on" to trigger the selected voices. Output is obtained as described in Paragraph 2–17.

2–19. PEDAL KEYING CIRCUIT (See Figure 5–6). – A signal of approximately 75 mV

P-P from the pedal keyboard is connected to the input T4. The first two stages using transistors Q1 & Q2 are basically amplifiers providing a +13 V square wave pulse for each input cycle. The first +13 V square wave pulse appearing on transistor Q2 collector turns on Q4 providing a +13 V pulse at output terminal T11. At the same time C4 is charged through R6. This charging time is long enough to delay the conduction of Q3 until after the first pulse; then Q3 conducts, cutting off Q4 before the second pulse can be passed. Effectively, each time a signal is applied to the input at T4, one pulse appears at the output terminal (T11), which connects to terminal F of voice generator board 124–000114. Q115 is normally off. The input at 'F' is fed through R163 to the base of Q115 to turn the transistor on. When Q115 is on, the DC voltage at its collector drops from +15V to Zero V. Note that pin 'G' is jumpered to pin 'C', and that both are common to Q115 collector.

The signal entering pin 'C' is fed through R160 to the base of Q114, which is normally in the "on" condition with no pedal pressed (collector at OV DC). When a pedal is pressed, the negative signal applied to the base turns "off" Q114, and the collector voltage rises to +15V DC. Point "D" is routed to point "A" and coupled through C127 and R156 to the base of Q112. Q112 which is normally "off" is turned "on", and its collector voltage drops to zero. The collector signal of Q112 is then fed to the base of PNP Q113, turning it "on", and its collector switches to +15 V DC. This +15V DC pulse on the collector of Q113 is designated as the pedal-down pulse, and is routed through the BLOCK and/or CYMBAL tabs, when "on" to trigger the selected voices. Output is obtained as described in Paragraph 2–17.

SECTION III
DISASSEMBLY

3–1. **GENERAL.** – This section contains descriptions of disassembly techniques peculiar to L–100 Series organs.

3–2. **ACCESS.** – For access to some of the parts discussed in following paragraphs, it may be necessary to remove organ top, back, or both.

3–3. **UPPER MANUAL KEY.** – To remove an upper manual key proceed according to the following.

a. Remove four screws which secure metal cover on control panel assembly.
b. Remove two large screws located at ends of control assembly, which secure it to upper manual.
c. To remove a black key, loosen its key mounting screw, lift control panel assembly and lift out key.
d. To remove a white key, loosen its key mounting screw and those of adjacent black keys. Lift control panel, push the keys back and lift out white key.

NOTE

If removal involves the lowest three keys, it will be necessary to remove or loosen drawbar assembly. See Paragraph 3–6.

3–4. **LOWER MANUAL KEY.** – To remove a lower manual key proceed according to the following.

a. Remove four screws which secure metal cover on control panel assembly.
b. Remove two upper manual mounting bolts which secure manual assembly to case work.
c. Remove two screws which pass through angle brackets into upper manual. These brackets are located inside of cheek blocks. These screws are accessible from front of organ.
d. Remove AO–41 and AO–42 amplifiers from rear of upper manual.
e. Tilt manual up from front.
f. Using 1/4" box ratchet, loosen key mounting screw.
g. To remove a black key, loosen its key mounting screw; unhook key from screw and lift out key.
h. To remove a white key loosen its key mounting screw and those of adjacent black keys. Unhook these keys from screws, push them back, and lift out white key.

3–5. **DRAWBAR CONTACT SPRING.** – To remove a drawbar contact spring proceed according to the following.

a. Remove four screws which secure metal cover on control panel assembly.
b. Push drawbar all the way in.
c. Remove screw at back end of drawbar.
d. Pull out contact spring. To disconnect spring entirely, unsolder wire.

CAUTION

Do not under any circumstances pull drawbar forward while contact spring is off, as damper spring will catch in slot and necessitate removal of entire drawbar assembly.

3–6. **DRAWBAR, DRAWBAR KNOBS OR DRAWBAR ASSEMBLY.** – To remove any of these, proceed according to the following.

a. Remove four screws which secure metal cover on control panel assembly.
b. Unsolder black wire from "Full Organ" tab switch.
c. Remove two large screws located at ends of control assembly which secure it to upper manual. Turn control panel face up, and prop up in this position, being careful not to stress wires.
d. Remove four hexagonal machine screws holding drawbar assembly to base.
e. To remove knob, tilt drawbar assembly up, and remove screw which holds knob.
f. To remove drawbar and contact spring, pull them out at back of assembly, while pressing with thumb to release pressure on contact.
g. To separate drawbar from contact spring, remove screw at back end of drawbar.
h. To remove entire drawbar assembly, unsolder all connecting wires.

3–7. UPPER MANUAL. – To remove upper manual proceed according to the following.

a. Remove four screws which secure metal cover on control panel assembly.
b. Unsolder black wire from full organ tab switch going to drawbar assembly.
c. Disconnect nine colored wires emanating from right end of upper manual which terminate at upper manual control tab switches.
d. Dismount AO–41 and AO–42 amplifiers from rear of upper manual.
e. Remove heavy grounding wire attached to manual just to right of first key channel.
f. Remove small bracket holding pedal click filter to manual (grey wire from pedal drawbar leads to this filter).
g. Remove two upper manual mounting bolts which secure manual assembly to case work.
h. Remove two screws which pass through angle brackets into upper manual. These brackets are located on inside of check blocks. The screws are accessible from front of organ.
i. Remove two screws securing control panel to upper manual and tilt control panel face up.
j. Remove four hexagonal machine screws holding drawbar assembly to base. Control panel and drawbar assembly can be folded over and rest on top of amplifiers.
k. Replace control panel mounting screws.
l. Prop up front of upper manual so that its terminal strip is accessible. Be careful when raising and lowering manual that its terminal strip is not damaged by rubbing lower manual keys.
m. Unsolder manual cable from terminal strip. Lower manual into normal position.
n. Carefully lift manual assembly out of console.

3–8. LOWER MANUAL. – To remove lower manual proceed according to the following.

a. Perform operations a. through e. of Paragraph 3–7.
b. Disconnect 9 colored wires emanating from right end of lower manual which terminate at lower manual control tab switch.
c. Remove four screws from under manual assembly (front) which secure terminal cover.
d. Remove lower manual end blocks by removing two screws through manual frame and one screw through bracket on cheek block.
e. Unsolder manual cable from terminal strip.
f. Tilt upper manual up from front. Remove two hexagonal bolts that secure lower manual to case work.
g. Loosen four hexagonal head studs securing lower manual to front rail. (In reinstalling manual tighten these last.)
h. Lift out lower manual.

3–9. GENERATOR. – To remove generator disconnect organ from power source, then proceed according to the following.

a. Remove generator power panel cover.
b. Unsolder all wires on power panel except yellow and grey wires to motor and starting condenser.
c. Dress generator-to-manual cable and generator-to-pedal cable down and unsolder from terminal strip.
d. Unsolder grey wire which goes to pedal click filter and remove heavy grounding wire (black).
e. Remove four hexagonal bolts which secure generator to mounting angles. Lift out generator.

3–10. MOTOR. – To remove motor disconnect organ from power source, then proceed according to the following.

a. Remove generator power panel cover.
b. Unsolder grey wire to motor.
c. Unsolder red and black wires on starting capacitor.
d. Compress coupling spring between motor and generator and remove spring.
e. Force off spring clamp which secures motor to mounting frame. Lift out motor.

3–11. PEDAL KEYBOARD. – To remove pedal keyboard proceed according to the following.

a. Dress down generator-to-manual and generator-to-pedal cables, unsoldering latter.
b. Remove two screws in lower back of console and three screws between amplifier and front of console.
c. Lift console and pull out keyboard. (When reinstalling pedal keyboard replace two screws in back of console first,

leaving them loose until remaining screws are replaced.)

3–12. SWELL ASSEMBLY. – To remove swell assembly, perform steps a. through d. If replacement of assembly is required, perform step e.

a. Remove two leads with white coded ends from preamplifier and main amplifier.
b. Remove four wood screws securing swell housing cover to case and lift out cover.
c. Remove four screws securing swell pedal assembly to case work. Swell assembly is now loose and can be picked up and removed from back.
d. Swell potentiometer can be removed at this time if necessary and will require an Allen 1/16" wrench.
e. Replacement for more dependable swell operation can be made by ordering Part Number 123–000021 from the factory, and proceeding as follows.
   1. Remove Expression Control housing.
   2. Unplug long shielded lead from Percussion Amp. Chassis and short shielded lead from Power Amp. Chassis.
   3. Remove four screws securing Expression Control Chassis to floor of cabinet.
   4. Remove Expression Control as one unit.
   5. Place new Expression Control in position and secure with original screws.
   6. Plug long shielded lead into Percussion Amp. jack and short lead into Power Amp. Jack.
   7. Using accompanying Terminal Strip, splice two Brown wires from Expression Control into Blue & Gray 6.3V filament leads originating in 6 pin rectangular plug on Power Amp. Chassis. Secure Terminal Strip to cabinet floor with small wood screw.
   8. Replace Expression Control Housing.

NOTE

If swell assembly is replaced as directed, circuitry will conform to Figures 5–3 and 5–4.

3–13. TO REPLACE A BROKEN TAB. – Proceed according to the following.

a. Remove four screws which secure metal cover on control panel assembly.
b. Remove two Phillips screws from front of control panel which hold bank of switches associated with tab to be replaced.
c. Remove lock washer from either end of switch assembly, and pull rod out so it just clears broken tab. It may be necessary to tilt assembly so that free end of rod will clear adjacent switch assembly.
d. Remove remains of broken tab and insert new piece.

NOTE

A small bronze spring washer will be found between tab and one side of switch assembly. Be sure this is reinserted with new tab.

3–14. PILOT LIGHT OR POWER SWITCH. – Disconnect organ from power source, then proceed according to the following.

a. Remove four screws which secure metal cover on control panel assembly.
b. Replace bulb with No. 12 GE 6.3V .15A miniature 2 pin.
c. To replace power switch, unsolder two black leads from generator power panel.
d. Compress springs on sides of switch and push through front of control panel.

3–15. PERCUSSION CIRCUITRY, L–100A. – With the exception of power supply and terminal strip assembly, Figure 5–13, the percussion circuitry is mounted on the lower left end block. If access to end block circuitry is required, remove control knobs before removing end block from organ.

3–16. SIX-VOICE PERCUSSION CIRCUITRY. L–100–1 The power supply, 127–000007 and pedal control board assembly, 063–042051, are mounted on the left (rear view) wall of the console.

The rhythm voice board, 124–000114, is located on the bottom left (rear view) of the console.

SECTION IV
PRACTICAL SERVICE SUGGESTIONS

4–1. GENERAL. – This section contains performance standards, adjustment procedures, and troubleshooting information.

NOTE

Before making any checks or adjustments involving amplifiers, test all tubes to be sure they are operating properly.

4–2. ORGAN PERFORMANCE CHECK. – To prepare the organ for performance check proceed according to the following.

a. Place all tabs in up (off) position.
b. Push drawbars in to limit of motion.
c. Set swell pedal for maximum output.
d. Connect meter to speaker terminals.

NOTES

At certain steps in the following procedure, conditions other than above may be specified. Return controls to above conditions as each step is completed.

Drawbars, pedals and keys are called out by number, beginning with No. 1, at left end of row.

4–3. EQUIPMENT REQUIRED. –

a. VTVM, Commander 870 or equivalent.
b. Oscilloscope, Tektronix 503 or equivalent.

4–4. PROCEDURE. –

a. Depress UPPER DRAWBARS tab and pull drawbar No. 1 to position 8. Play lowest C, on upper manual (Frequency 25) and observe meter. If output is not between 1.6V and 2V rms, adjust GAIN ADJUST on power amplifier to bring output into range.
b. Maintain conditions of step a. Depress VOLUME SOFT tab. Output should drop to range of 0.69 to 0.9 volts rms.
c. Set pedal drawbar at position 8. Depress lowest C pedal. Output should be between 4V and 5.5V rms.

NOTE

If output is not within specified range, select R1, Figures 5–1 through 5–4, from 1.8Ω to 27Ω to bring output into range.

d. Maintain conditions of step c. Depress VOLUME SOFT tab. Output should drop to 0.8V to 1.5V rms.
e. Return VOLUME SOFT tab to "up" position. Maintain other conditions of step c. Play all pedals to be sure output changes smoothly from note to note.
f. Make upper manual preset listening check. Hold down F, A, C chord near center of upper manual.
   1. Trumpet. Set up upper drawbars to 00 6688 888. Press TRUMPET preset and then UPPER DRAWBARS preset. The musical quality should be identical.
   2. Clarinet. Set up upper drawbars to 00 8080 800. Press CLARINET preset and then UPPER DRAWBARS preset. The musical quality should be identical.
   3. Full organ. Set up upper drawbars to 86 8868 446. Press FULL ORGAN preset and the UPPER DRAWBARS preset. The musical quality should be identical.
g. Make lower manual preset listening check. Hold down F, A, C chord near center of lower manual.
   1. Set up lower drawbars to 6644 222.
   2. Press ENSEMBLE preset and then LOWER DRAWBARS preset. The musical quality should be identical.
h. Percussion cutoff control and output checks.
   1. Cut-off. With only THIRD HARMONIC, FAST DECAY, and UPPER DRAWBARS tablets depressed and all drawbars pushed in, hold down lowest C key on upper manual and adjust percussion cut-off control on preamplifier chassis to point at which output signal is just barely audible.
   2. Output voltages. With only UPPER DRAWBARS and SECOND HARMONIC tablets depressed, press lowest C key on upper manual. Output voltages across speakers should be between

3.0V and 5.5V rms. With PERCUSSION SOFT tablet depressed, output should be 1.5V to 2.8V rms.

i. Vibrato check. Depress FULL ORGAN tab. Hold down F, A, C chord near center of upper manual. Depress VIBRATO SMALL tab and observe vibrato effect. Then, in addition, depress VIBRATO NORMAL tab. Vibrato effect should increase. In addition, press VIBRATO CHORUS tab. Vibrato effect should become more pronounced.

NOTE

Later organs, Figures 5–2 through 5–4, are equipped with vibrato width potentiometer R131. Adjust if vibrato effect is too narrow or too broad.

j. Reverberation check. Depress FULL ORGAN tab. Hold down F, A, C chord near center of upper manual. Add REVERB I tab. Observe that reverberation is heard as chord is played and released. Add REVERB II tab. Reverberation should be increased relative to REVERB I tab as chord is played and released.

k. Microphonics and Hum check.
1. Tap each tube and replace it if there is ring or howl in the speaker with expression pedal maximum and VOLUME SOFT tab not depressed.
2. Hum in speakers with expression pedal maximum and VOLUME SOFT tablet not depressed must be very low in volume and not measure more than 15 mV rms. If hum is excessive, see paragraph 4–22.

NOTE

On L–100–2 the SILENT-SOUND tab on Rhythm II must be in SILENT position.

4–5. **VIBRATO.** – To check vibrato proceed according to the following.

a. Pull out upper manual 2' drawbar to position 8. All other drawbars in. Depress UPPER DRAWBARS tab.
b. Remove the phono cable from the BN. phono jack located on the preamplifier chassis. Connect the scope VERTICAL INPUT to the phono plug removed.
c. Remove the phono cable from the BK. phono jack located on the vibrato phase shift amplifier. Insert into the BK. phono jack an adapter with two phono jacks and one phono plug. Reconnect the phono cable (black) into one of the adapter phono jacks and connect the scope EXT. TRIGGER IN binding post to the remaining adapter phono jack.
d. Set scope controls as follows:
1. TRIGGER: SOURCE – EXT., COUPLING – AC; SLOPE +
2. HORIZONTAL SWEEP – 0.2 msec/cm.
3. VERTICAL SENSITIVITY – 0.2 volt/cm.
e. Hold down key #7 (frequency #60) on the upper manual.
f. Adjust the TRIGGER LEVEL control for a stable pattern.
g. Adjust the VARIABLE sweep time control until one complete sinewave covers 4 cm.
h. Adjust the VERTICAL VARIABLE control for a display height of 4 cm.
i. Depress the VIBRATO NORMAL tab. Adjust the VIBRATO WIDTH control for a total phase shift swing of 2 cm. (refer to Figure 4–1). If VIBRATO WIDTH control does not give satisfactory result, select R133, Figure 5–1 through 5–4 between 220Ω and 1K.

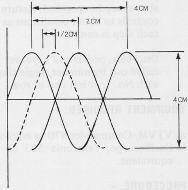


Figure 4–1. Vibrato Adjustment Waveform

NOTE

Phase shift can be read best if waveform is centered so that the center peak of the sinewave coincides with a graticule line.

j. Release VIBRATO NORMAL tab. Single wave must be centered ± ½ cm. as shown in Figure 4–1.
k. Disconnect external leads and adapter. Reconnect phono cables to proper jacks.

If an oscilloscope is not available, make the following listening test.

Depress FULL ORGAN tab. Hold down F, A, C chord near center of upper manual. Depress VIBRATO SMALL tab and observe vibrato effect. Add VIBRATO NORMAL tab and observe increased vibrato. Add VIBRATO CHORUS tab and observe that vibrato effect becomes more pronounced.

4–6. L–100A PERCUSSION PERFORMANCE CHECK. – To check performance of L–100A percussion unit, whether factory installed, or added as a kit, proceed according to the following.

a. Selector Switch Operation

1. With selector switch in DRAWBARS position, cymbal-brush switch OFF, mode switch in NORMAL position, organ function should be normal.
2. DRAWBARS position - with upper manual DRAWBAR tab depressed and holding down middle C key, pull out all drawbars in order, starting with the highest one. Note that pitch of sound goes down each time with the exception of sub-3rd drawbar. Return upper DRAWBAR tab to OFF.
3. Percussion level - with mode switch in VIBRATO position, selector switch in Marimba position, lower manual DRAWBAR tab depressed and lower drawbars registration 8800 000 and swell pedal maximum loudness, the level is checked by comparing level of upper manual to level of lower manual when depressing middle C and E keys in a percussive manner. Level should be approximately equal. Variation heard in level in the reiteration, normal, and delayed vibrato positions of the mode switch are normal. Notice a decrease in level when PERCUSSION SOFT tab is depressed in all but reiteration modes.
4. Percussion voices of the selector switch are checked for harmonic content by comparison with lower manual registration. Play middle C and E keys except when comparing chimes which should be checked using middle C key only.
5. CHIMES should be identical to drawbar registration 0888 000, except that 1–1/4 harmonic will be missing from the drawbar registration.
6. GUITAR should be identical to registration 8088 800.
7. MARIMBA should be identical to registration 8800 000.
8. XYLOPHONE should be identical to registration 8080 000.
9. BANJO should be identical to registration 0888 800.

NOTES

When the harmonic is used to form the percussion voice, then the corresponding drawbar on the upper manual and (keying) drawbar #8 will be inoperative.

In CHIMES position, drawbar #7 will also be inoperative.

CHIMES & GUITAR decay time approximately 3 seconds, other percussion voices slightly less than 1/2 second.

In VIBRATO & DELAYED VIBRATO positions of mode switch, all percussions will have the long decay time (3 seconds).

b. Mode Switch Operation (Vibrato Functions)

1. All control panel tabs and drawbars in OFF position.
2. Selector switch to GUITAR position.
3. Mode switch NORMAL position - play chord on upper manual and notice absence of vibrato effect.
4. Mode switch to VIBRATO position, depress vibrato normal tab - play chord on upper manual and notice vibrato effect.
5. Mode switch to DELAYED VIBRATO position - play chord on upper manual and notice that vibrato effect begins approximately .6 of a second delayed in time, after chord is pressed.

c. Mode Switch Operation (Reiteration Functions)

1. Selector switch to CHIME or GUITAR position.
2. Mode switch to FAST position, and pressing key on upper manual produces a reiterative sound, repeating at the rate of approximately 11.2 HZ.
3. Mode switch to MEDIUM position - playing as above, produces a reiterative sound with rate of approximately 7.7 HZ.
4. Mode switch to SLOW position - playing as above, produces a reiterative sound with rate of approximately 5.4 HZ.

5. Notice that if selector switch is turned to MARIMBA or XYLOPHONE positions, a reiterative sound of different quality is heard. The two harmonics used in these voices are turned on and off at opposite times. This is known as "alternate reiteration".

d. Cymbal-Brush Switch Operation

1. With lower manual DRAWBARS tab switch depressed, and CYMBAL-BRUSH switch off, lower manual drawbars should function normally.
2. With CYMBAL-BRUSH switch to any on-position, drawbar #7 will be inoperative.
3. With lower manual DRAWBAR tab up, and Brush & Cymbal switch in LOUD position, depress BRILLIANCE tab, playing any lower manual key repeatedly (other than highest 6 keys on right-side of manuals). The result should be a percussive hiss sound of 1.0 V ± 3 db rms measured across 12" speaker leads. R602 may be adjusted to obtain the proper levels. R602 is located on terminal strip assembly, AO–31213–1.
4. With Cymbal and Brush switch in LOUD position, play any pedal repeatedly, and notice percussive hiss sound of 1.25 V ± 3db rms.
5. Notice that when BRILLANCE tab is turned off, volume of Brush and Cymbal is decreased.

4–7. L–100–1 SIX-VOICE PERCUSSION PERFORMANCE CHECK AND TROUBLESHOOTING.

4–8. OUTPUT LEVEL ADJUSTMENTS. – The rhythm volume levels are set at the factory, and will normally require no adjustment. In case it is found necessary to replace a part on the rhythm board, 124–000114, adjustment will be required. To adjust output levels, proceed according to the following. A VTVM, Millivolt Commander, Model 870, or equivalent is required. See Figure 5–6 for locations of controls.

a. Set all tabs and rocker switches to "up" or "off" positions. Set swell pedal and RHYTHM VOLUME control to maximum output.

b. Connect VTVM across main speaker leads.

c. Press CYMBAL push button at about 5 times per second. Adjust R113 to obtain a meter indication of 2.2 to 2.8 V rms.

d. Press BRUSH push button at about 5 times per second. Adjust R126 to obtain a meter indication of 2.2 to 2.8 V rms.

e. Press TOM-TOM push button at about 5 times per second. Adjust R134 to obtain a meter indication of 1.3 to 1.7 V rms.

4–9. ONE VOICE IS SILENT. – Check the following:

a. Connection to corresponding pin of PWB, 124–000114, See Figure 5–6.

b. If connections O.K., check for +15 V DC at pin when push button of missing voice is held down.

c. If voltage is missing, check connections to push button switch, rocker tab, and rhythm power supply.

d. If voltage is present, trace associated voice circuitry.

NOTE

If failure is in Brush and/or Cymbal voice, check Q101.

4–10. PROGRAMMED VOICE DOES NOT SPEAK. – If any voice speaks when push button is pressed, but not from programmed source (manual or pedal, as applicable), check rocker switch and associated wiring. See Paragraphs 4–13 and 4–14 also.

4–11. ALL PERCUSSIVE VOICES SILENT. – (Hiss voices speak.) Check Q107, Q108, and associated circuitry.

4–12. BOTH HISS VOICES SILENT – (Percussive Voices Speak.) Check Q106 and associated circuitry. Check Q101.

4–13. NO VOICE RESPONSE FROM PEDALS. – Check pedal keying pulse circuits. Paragraph 2–19.

4–14. NO VOICE RESPONSE FROM MANUAL. – Check manual keying pulse circuits. Paragraph 2–18.

4–15. NO PERCUSSION OUTPUT. – Check connections to percussion power supply. Check power supply outputs.

4–16. TROUBLESHOOTING.

4–17. ORGAN DOES NOT PLAY. –

a. If the generator motor is not turning and the tubes do not light when the switch is in the "on" position, check the power wiring, power switch, line cord, line cord plug, and wall outlet.

b. If the generator turns and the tubes light, but no sound can be obtained with all controls in playing position, the most likely source of trouble is the amplifier. In most respects this is a conventional amplifier circuit, and the schematic diagrams, Figures 5–1 through 5–4, will enable the service man to locate the trouble.

4–18. KEY DOES NOT PLAY OR HARMONIC IS MISSING. – This may mean a dirty key contact, a broken connection, or a dead note in the generator. The steps below will serve to isolate the trouble.

NOTE

Checks a through i, following, must be performed with the DRAWBARS tab depressed.

a. Ordinarily only one of the several frequencies used on the key will be missing. This can be determined by holding the key and operating each drawbar for that manual, observing on which drawbar the key fails to play. Reference to the manual wiring chart, Figure 1–7, will tell which frequency number is missing.

b. See whether the same frequency is missing where it is used on other keys of the same manual. The wiring chart will tell with what other key and what other drawbar you should get the same frequency. If it is missing on one key but not on others, a key contact is probably dirty. In some cases it may be cleared by striking the key 15 or 20 times in a rapid staccato manner to loosen the dirt. If this procedure is not effective, adjustment of the busbar shifter for that manual will clear it. (See paragraph 1–5.) This will slide the busbars endwise so they present a clean contact surface. In extreme cases, it may be necessary to hold down the faulty key while making the adjustment.

c. If the frequency is missing on all keys of one manual but not on the other manual, look for a break in the cable connecting one manual to the other.

d. If the frequency is missing on both manuals, check the manual-to-generator cable or the generator itself.

e. The output of any single frequency on the tone generator may be checked by pulling out any drawbar and connecting a clip lead from the back end of the drawbar to the generator terminal in question. See figure 6 for location of all generator terminals. If the generator is all right, the note will play loudly.

CAUTION

Never test the tone generator with an outside source of current such as a continuity meter, as serious damage may result to the sensitive filter transformers and permanent magnets. By the above method, all necessary tests of the tone generator may be made with the current supplied by the generator itself.

f. If it fails to play, try touching the clip to the input side of the filter coil (not the grounded tap) and the input side of the filter condenser (Figure 1–6) in order to check these parts. Disconnect the condenser to eliminate the possibility of a grounded transformer. If the signal is still missing at the magnet coil terminal, it means that the tone wheel is not turning, the coil is defective, or the magnet is not properly adjusted.

g. If the tone wheel is not turning, the frequency of the other wheel on the same shaft will also be missing (with the exception of a few wheels which are alone). On the generator magnet location drawing (Figure 1–5), the two frequencies whose numbers are connected by a dotted line are on the same shaft. Another way to check the wheel is to remove the dampening pad under the generator (it is held by the two long channels which form the generator frame) and feel the wheel with your finger to see if it is turning. Each wheel is located directly behind its magnet, shown in Figure 1–5.

h. If the magnet coil is defective, the generator must be returned to the factory, as replacement of a coil necessitates dismantling the entire generator.

i. It is possible, although unlikely, that the magnet may have become loose and moved so far from the wheel as to make the note inaudible. It may be adjusted as described in the following paragraph.

SECTION V
DIAGRAMS

5–1. **GENERAL.** – This section contains schematic diagrams to illustrate the text and provide information necessary to proper organ servicing.

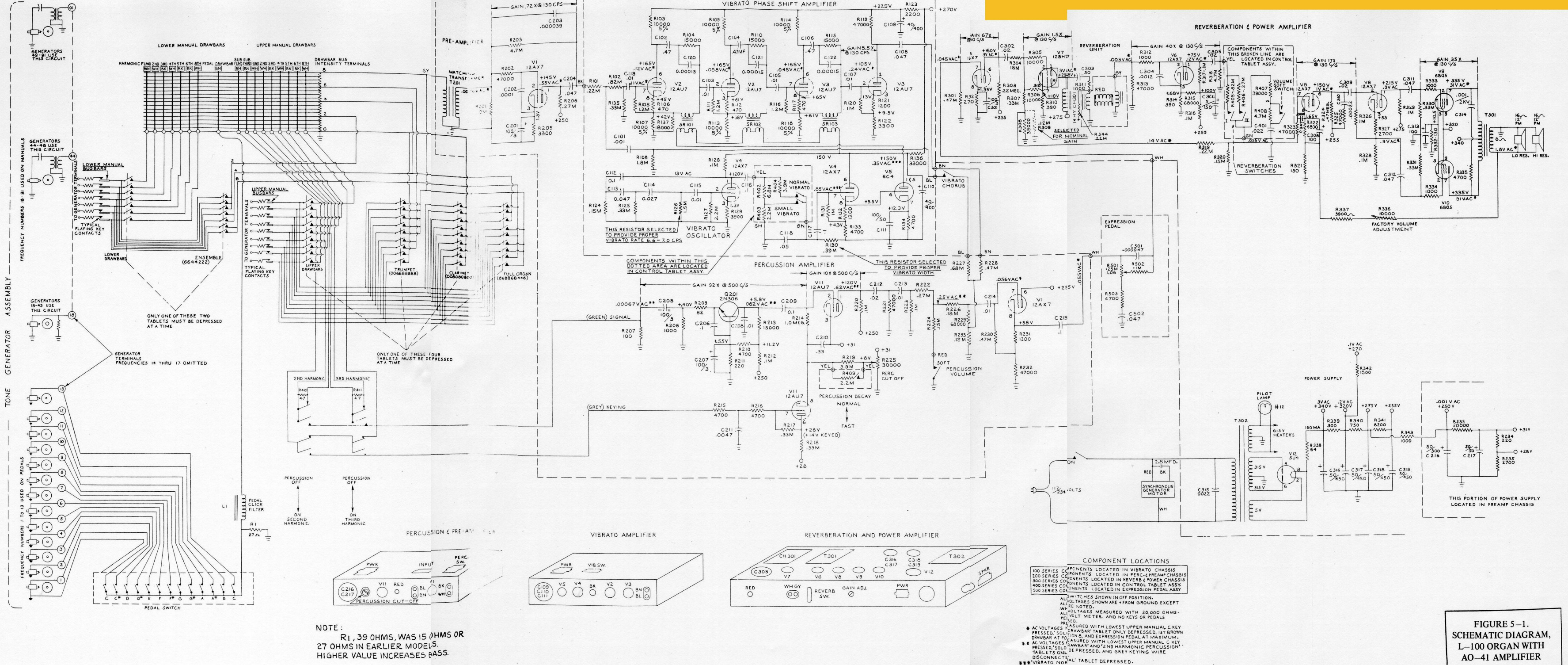


FIGURE 5–1. SCHEMATIC DIAGRAM, L–100 ORGAN WITH AO–41 AMPLIFIER


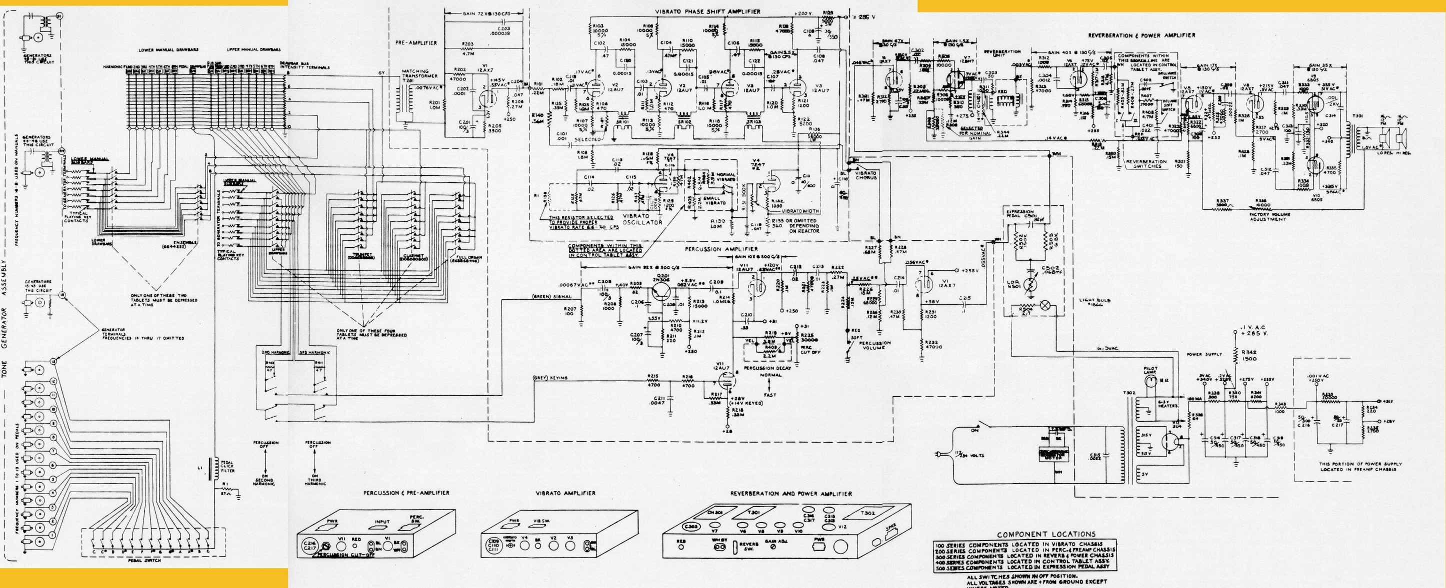


FIGURE 5-2.
SCHEMATIC DIAGRAM,
L-100 ORGAN WITH
AO-47 AMPLIFIER

MODEL L101 CONSOLES SERIAL #41622 AND ABOVE
MODEL L102 CONSOLES SERIAL #42028 AND ABOVE
MODEL L103 CONSOLES SERIAL #43102 AND ABOVE
} C-402 BRILLANCE CAPACITOR ADDED. NO TABLET



COMPONENT LOCATIONS

100 SERIES COMPONENTS LOCATED IN VIBRATO CHASSIS
200 SERIES COMPONENTS LOCATED IN PERC. & PREAMP CHASSIS
300 SERIES COMPONENTS LOCATED IN REVERB & POWER CHASSIS
400 SERIES COMPONENTS LOCATED IN CONTROL TABLET ASSY.
500 SERIES COMPONENTS LOCATED IN EXPRESSION PEDAL ASSY

ALL SWITCHES SHOWN IN OFF POSITION.
ALL VOLTAGES SHOWN ARE + FROM GROUND EXCEPT WHERE NOTED.
ALL VOLTAGES MEASURED WITH 20,000 OHMS-PER-VOLT METER. AND NO KEYS OR PEDALS PRESSED.

* AC VOLTAGES MEASURED WITH LOWEST UPPER MANUAL C KEY PRESSED, 'SOLO DRAWBAR' TABLET ONLY DEPRESSED, 1st BROWN DRAWBAR AT POSITION 8, AND EXPRESSION PEDAL AT MAXIMUM.

** AC VOLTAGES MEASURED WITH LOWEST UPPER MANUAL C KEY PRESSED, 'SOLO DRAWBAR' AND '2ND HARMONIC PERCUSSION' TABLETS ONLY DEPRESSED, AND GREY KEYING WIRE DISCONNECTED.

*** 'VIBRATO NORMAL' TABLET DEPRESSED.

MODEL L-111 CONSOLES SERIAL #64145 AND ABOVE, PHOTOCELL EXPRESSION CONTROL ADDED.
MODEL L-112 CONSOLES SERIAL #64644 AND ABOVE, PHOTOCELL EXPRESSION CONTROL ADDED.
MODEL L-122 CONSOLES SERIAL #62977 AND ABOVE, PHOTOCELL EXPRESSION CONTROL ADDED.
MODEL L-133 CONSOLES SERIAL #65765 AND ABOVE, PHOTOCELL EXPRESSION CONTROL ADDED.

FIGURE 5–3.
SCHEMATIC DIAGRAM,
L–100 ORGAN WITH AO–47 AMPLIFIER


FIGURE 5-4.
SCHEMATIC DIAGRAM,
L-100A, L-100-1 & L-100-2
ORGAN CONSOLE

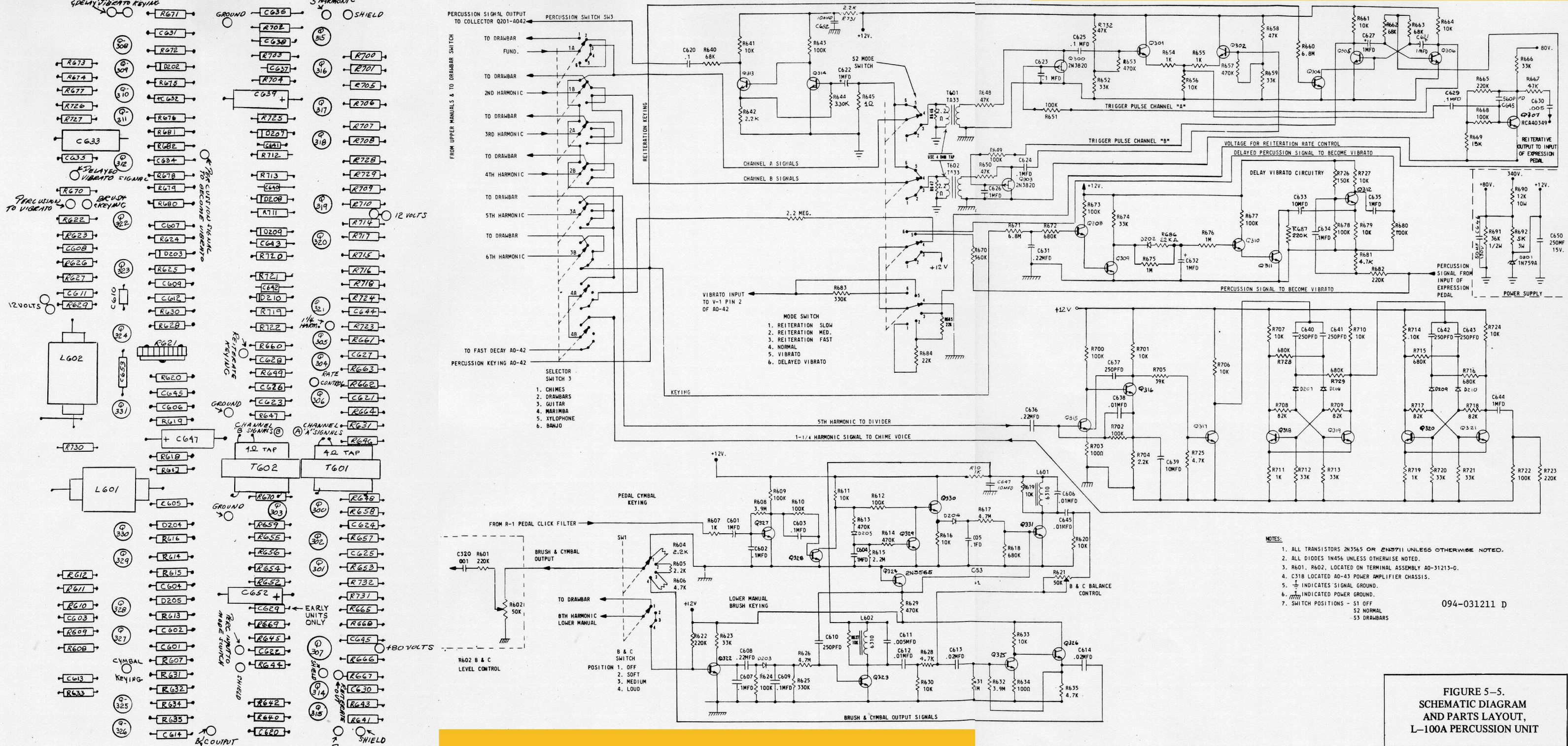
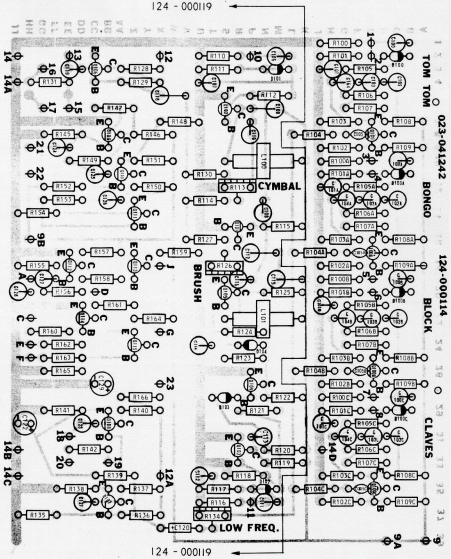
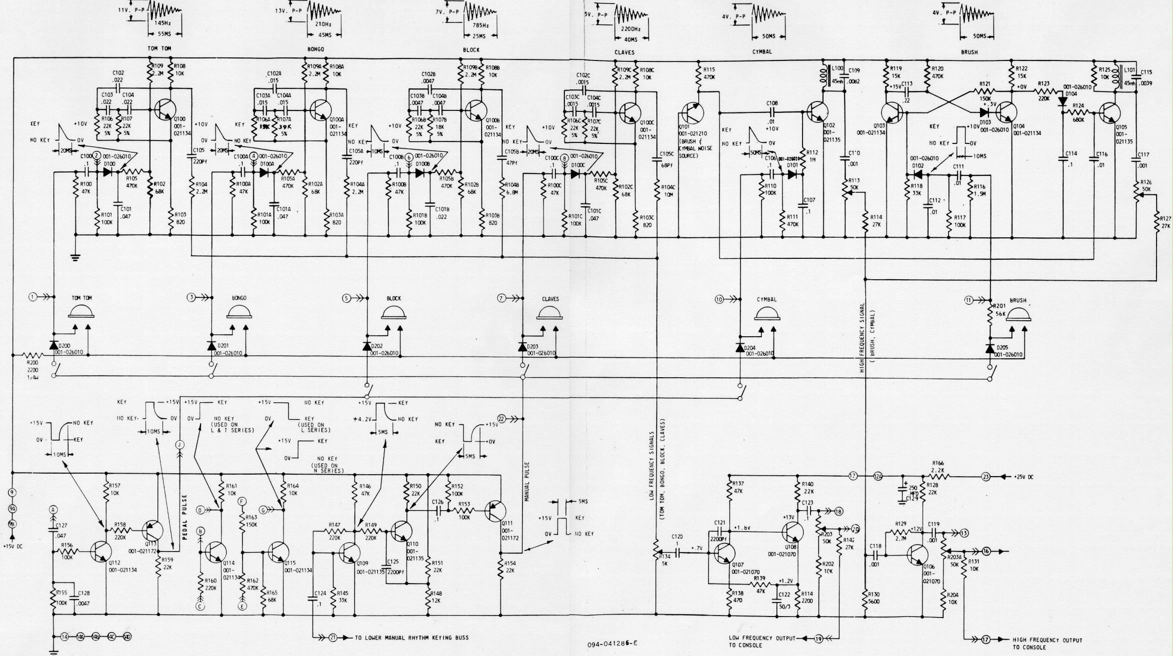


FIGURE 5–5.
SCHEMATIC DIAGRAM
AND PARTS LAYOUT,
L–100A PERCUSSION UNIT

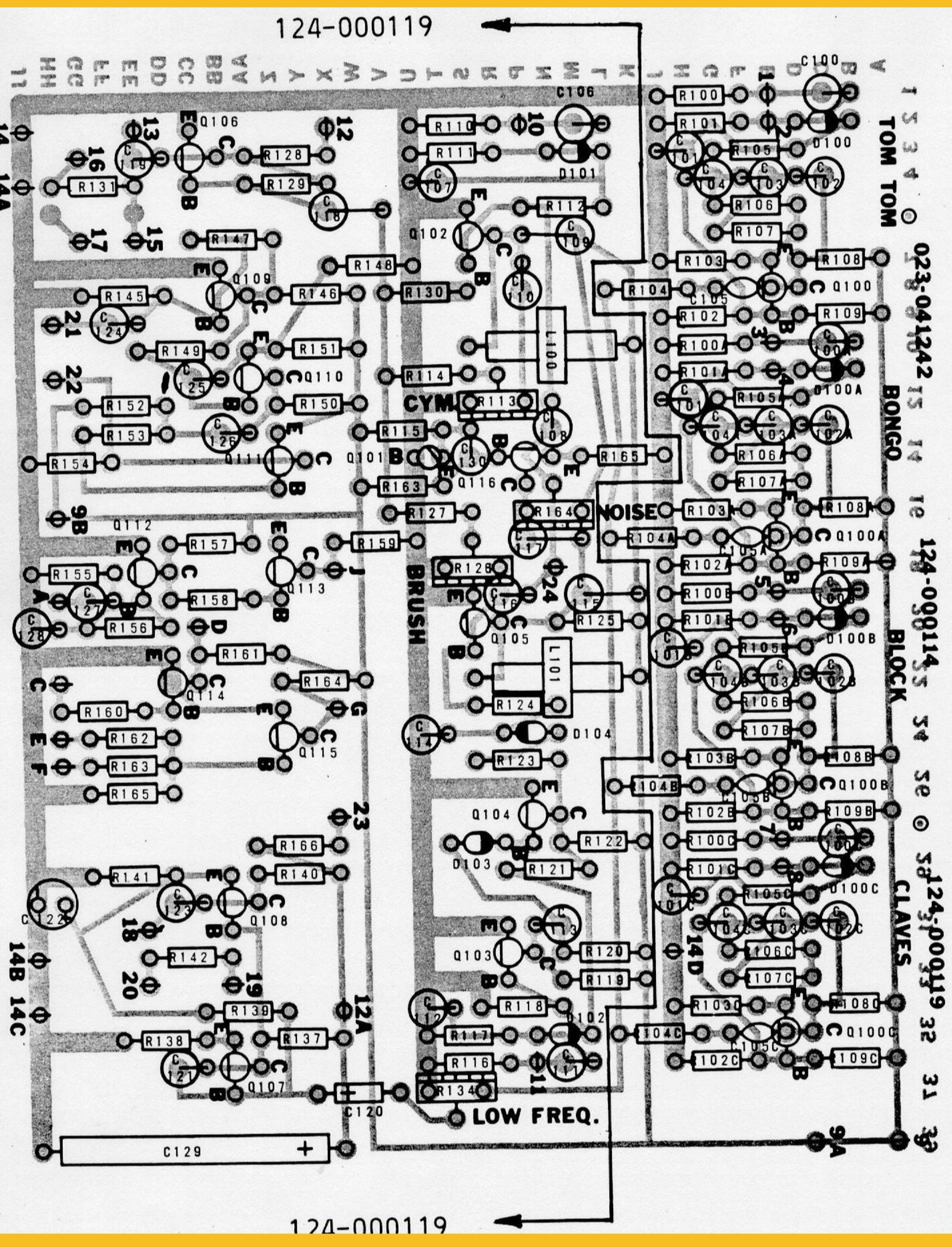




NOTES:

1. ≪ SYMBOL DENOTES PUSH-ON TERMINALS & -○- : PINS.
2. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE IN OHMS, ± 10%, 1/2 WATT;
   ALL CAPACITORS ARE IN MICROFARADS.
3. 200 SERIES COMPONENTS LOCATED IN END BLOCK ASSEMBLY.
4. T-200-1,2 CONSOLE SERIES JUMPER REQUIRED BETWEEN A TO D , PEDAL INPUT C.
5. PINS 2,4,6,8 FACTORY TEST POINTS ONLY.
6. L-100-1,2 CONSOLE SERIES JUMPER REQUIRED BETWEEN A TO D, AND C TO G, PEDAL INPUT TO F.
7. N-100, N-200, N-300 CONSOLE SERIES JUMPER REQUIRED BETWEEN 9B TO E, AND A TO G WITH PEDAL INPUT TO F.
8. WAVE FORMS OF TOM TOM, BONGO, BLOCK AND CLAVES AT TERM. #18.
9. WAVE FORMS OF BRUSH & CYMBAL AT TERM. #13.

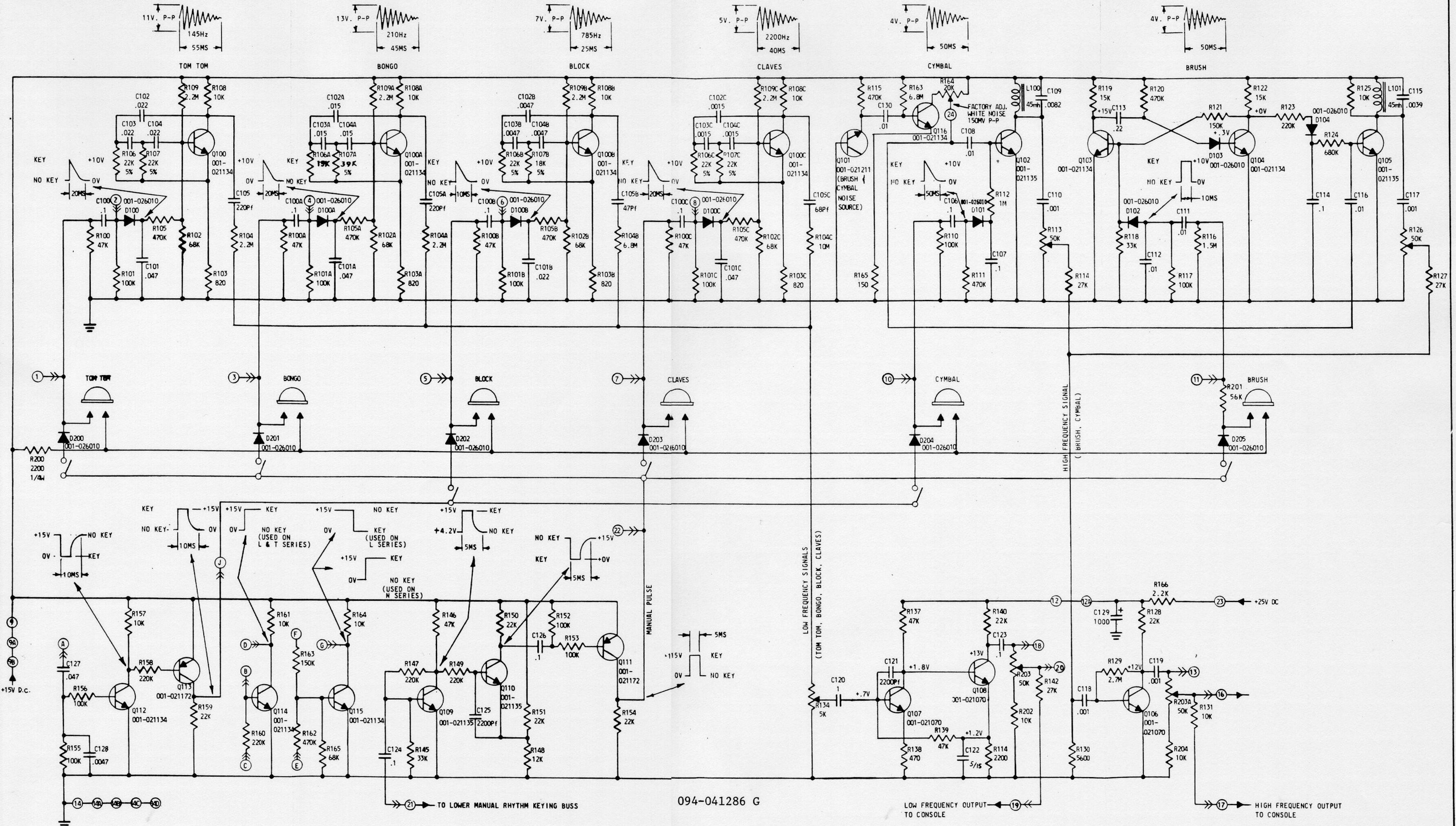
FIGURE 5–6.
SCHEMATIC DIAGRAM
AND PARTS LAYOUT,
L–100–1 SIX-VOICE PERCUSSION



SCHEMATIC DIAGRAM CORRECTIONS

TO CORRECT THE SCHEMATIC DIAGRAM FOR PROPER SERVICING THE FOLLOWING CHANGES HAVE BEEN MADE.

1. CALL OUT CHANGE:
   R163 CHANGED TO R168
   R164 CHANGED TO R169
   R165 CHANGED TO R167
   R114 CHANGED TO R141
2. TOLERANCE CHANGE:
   R102, R102A, R102B, R102C, R165 CHANGED TO 5%
3. VALUE CHANGE:
   R107 CHANGED TO 27K
4. CALLOUT AND VALUE INTERCHANGE:
   R107-27K WITH R106-22K
   R107A-39K WITH R106A-15K
   R107B-18K WITH R106B-22K
   R107C-22K WITH R106C-22K



NOTES:

1. ≪ SYMBOL DENOTES PUSH-ON TERMINALS & -○- : PINS.
2. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE IN OHMS, ± 10%, 1/2 WATT;
   ALL CAPACITORS ARE IN MICROFARADS.
3. 200 SERIES COMPONENTS LOCATED IN END BLOCK ASSEMBLY.
4. T-200-1,2 CONSOLE SERIES JUMPER REQUIRED BETWEEN A TO D , PEDAL INPUT C.
5. PINS 2,4,6,8 FACTORY TEST POINTS ONLY.
6. L-100-1,2 CONSOLE SERIES JUMPER REQUIRED BETWEEN A TO D, AND C TO G, PEDAL INPUT TO F.
7. N-100, N-200, N-300 CONSOLE SERIES JUMPER REQUIRED BETWEEN 9B TO E, AND A TO G WITH PEDAL INPUT TO F.
8. WAVE FORMS OF TOM TOM, BONGO, BLOCK AND CLAVES AT TERM. #18.
9. WAVE FORMS OF BRUSH & CYMBAL AT TERM. #13.

FIGURE 5–6A
SCHEMATIC DIAGRAM AND PARTS LAYOUT,
L–100–1 SIX-VOICE PERCUSSION,
EARLY 1970 PRODUCTION

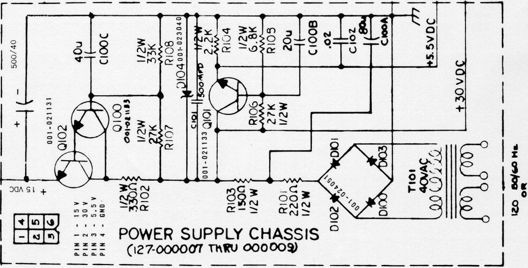
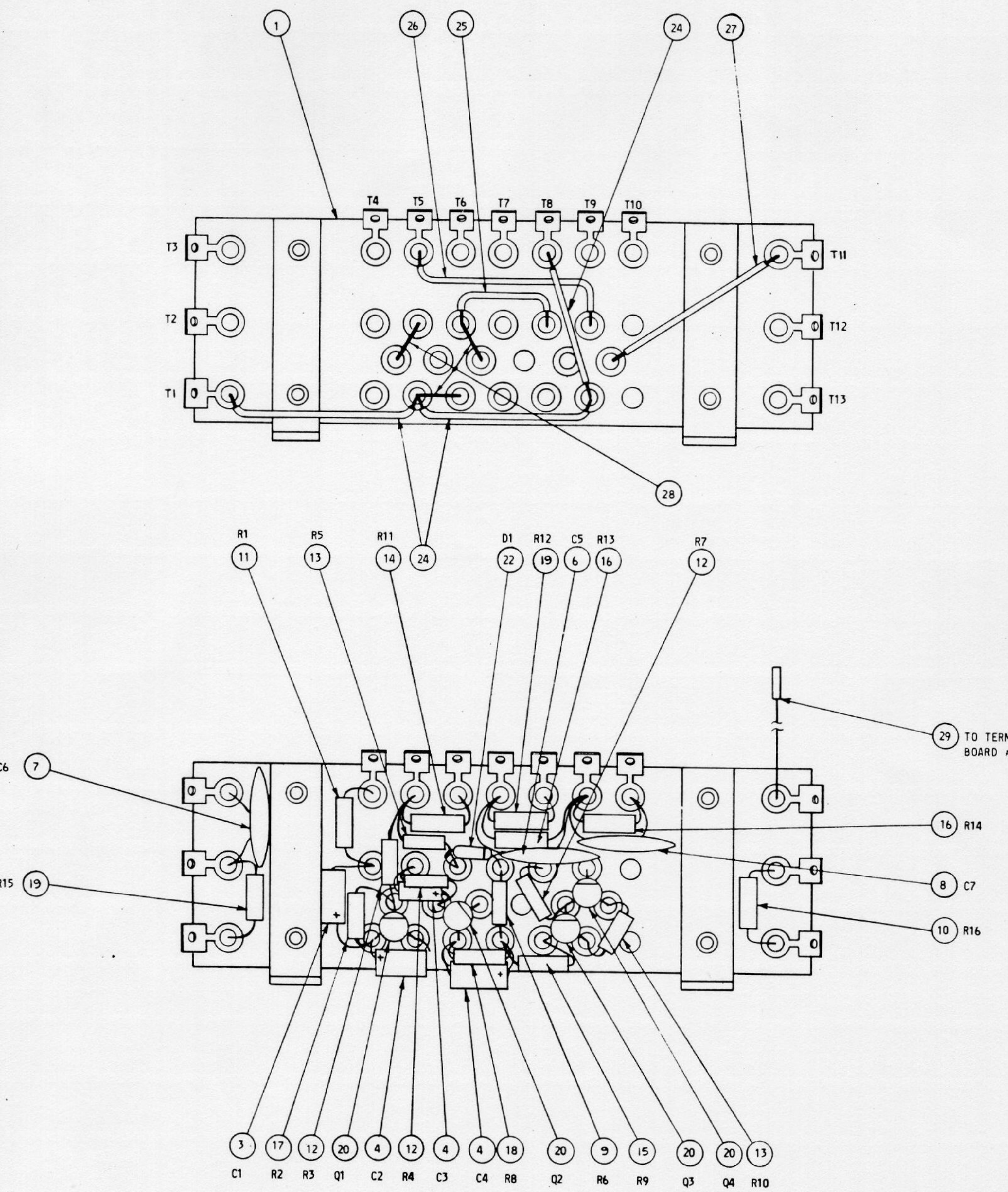
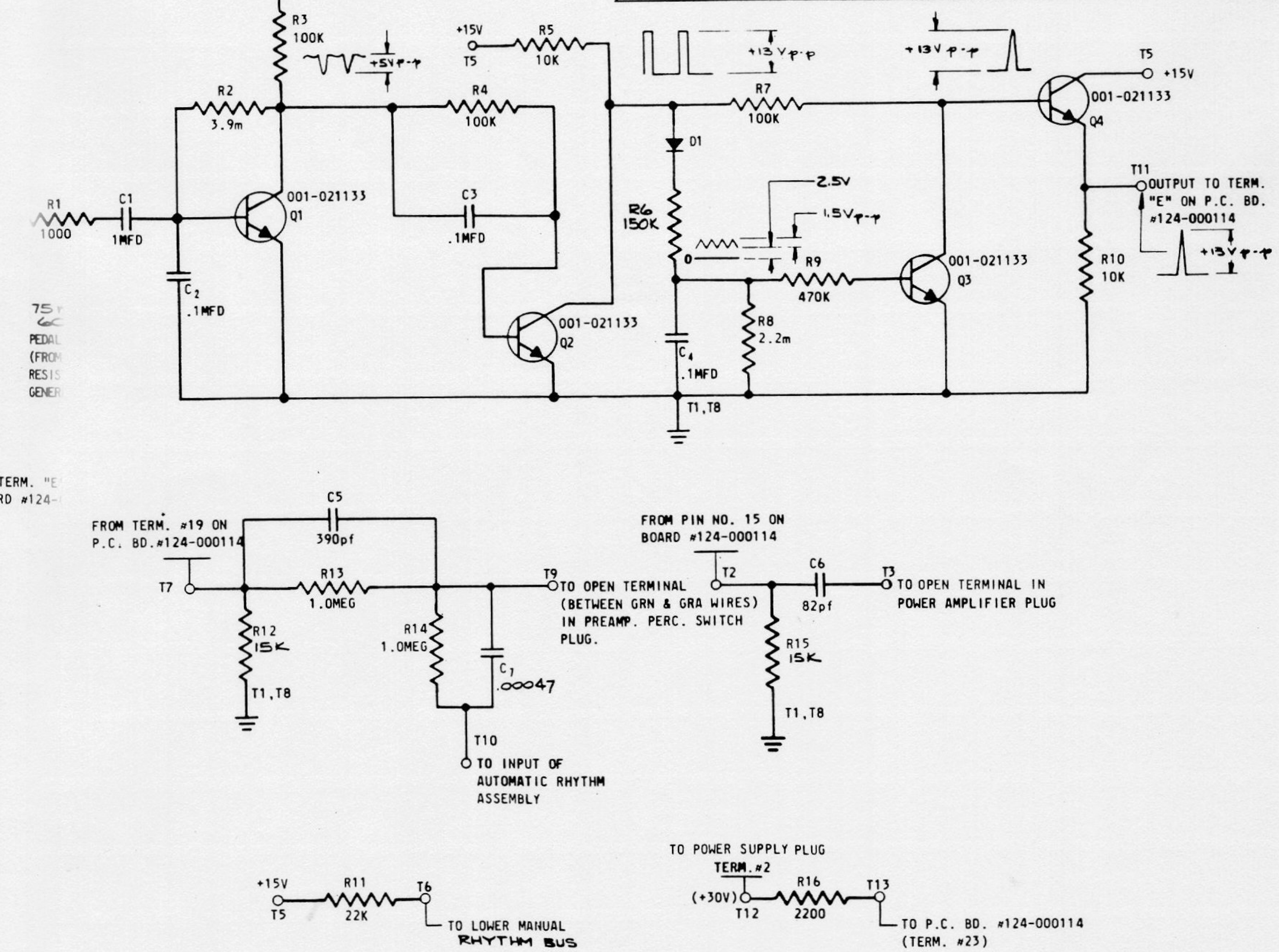


Figure 5–7. Schematic Diagram, L-100-1 Percussion Power Supply

063-042051	PART NO.	ITEM NO.	PART NAME	REMARKS
1	006-041578	1	TERMINAL BOARD ASSEMBLY	
		2		
1	414-040092	3	CAPACITOR, TANTALUM	C1 1.0 MFD.
3	414-040012	4	CAPACITOR, TANTALUM	C2,C3,C4 .10 MFD.
		5		
1	425-010392	6	CAPACITOR, CERAMIC	C5 390 mmfd
1	425-010232	7	CAPACITOR, CERAMIC	C6 82 mmfd
1	425-010412	8	CAPACITOR, CERAMIC	C7 470 mmfd
1	600-021011	9	RESISTOR, FIXED	R6 150K
1	600-020571	10	RESISTOR, FIXED	R16 2200 Ω
1	600-020491	11	RESISTOR, FIXED	R1 1000 Ω
3	600-020971	12	RESISTOR, FIXED	R3,R4,R7 100 K
2	600-020731	13	RESISTOR, FIXED	R5,R10 10 K
1	600-020811	14	RESISTOR, FIXED	R11, 22 K
1	600-021131	15	RESISTOR, FIXED	R9 470 K
2	600-021211	16	RESISTOR, FIXED	R13,R14 1.0 MEG
1	600-021351	17	RESISTOR, FIXED	R2 3.9 MEG
1	600-021291	18	RESISTOR, FIXED	R8 2.2 MEG
2	600-020771	19	RESISTOR, FIXED	R12, R15 15 K
4	001-021133	20	TRANSISTOR	Q1,Q2,Q3,Q4
		21		
1	001-026030	22	DIODE	D1
		23		
3	202-000004-07	24	#24 GA. S.C. SOLID WIRE	BLK
1	202-010004-07	25	#24 GA. S.C. SOLID WIRE	BRN
1	202-020004-07	26	#24 GA. S.C. SOLID WIRE	RED
1	202-040004-07	27	#24 GA. S.C. SOLID WIRE	YEL
3	299-220002	28	#22 GA. S.C. SOLID WIRE	BARE
1	011-041194	29	WIRE & PIN ASSEMBLY	GRA
A/R	015-033302	30	ROSIN CORE SOLDER	60/40





063-042051 A

FIGURE 5–8.
SCHEMATIC DIAGRAM
AND PARTS LAYOUT,
PEDAL CONTROL BOARD

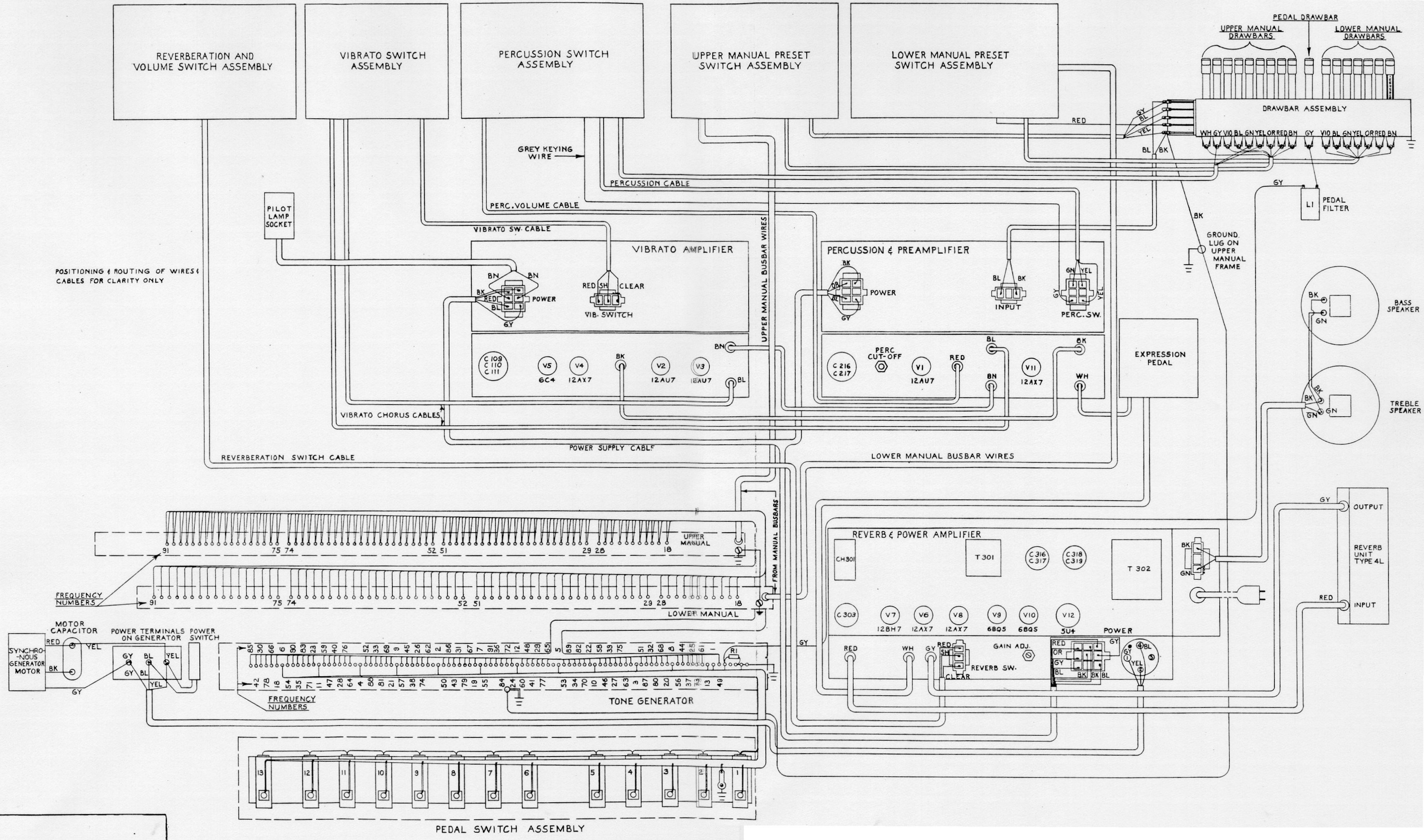
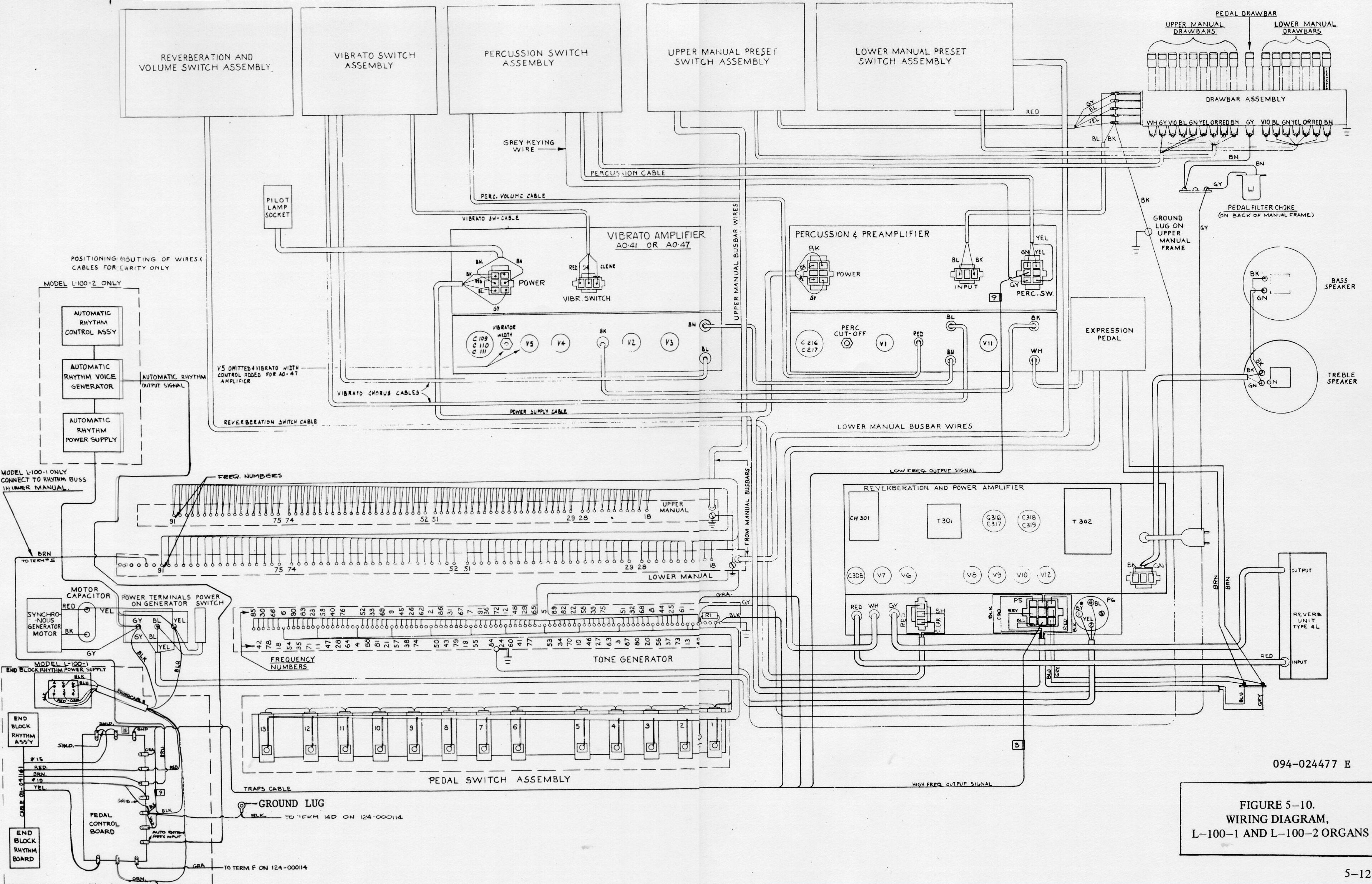


FIGURE 5–9.
WIRING DIAGRAM,
L–100 ORGAN



094-024477 E

FIGURE 5–10.
WIRING DIAGRAM,
L–100–1 AND L–100–2 ORGANS

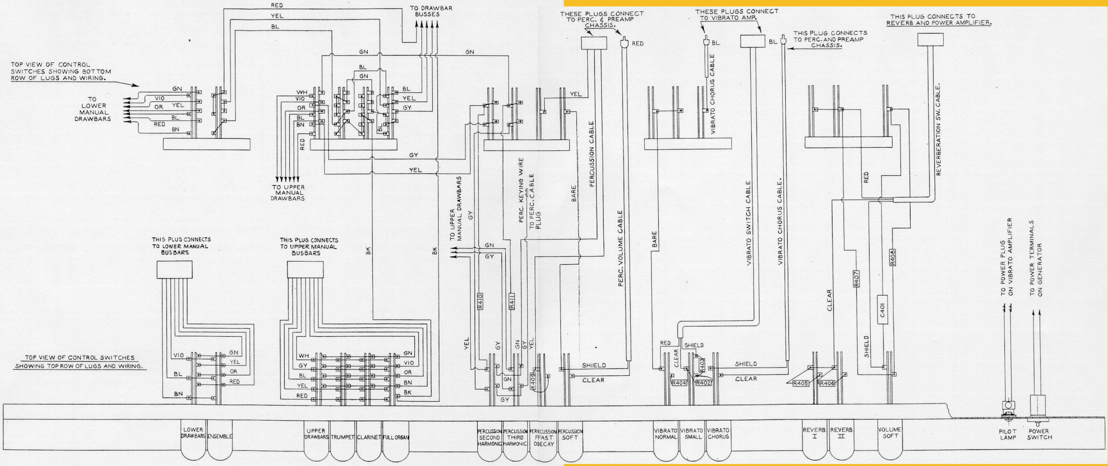
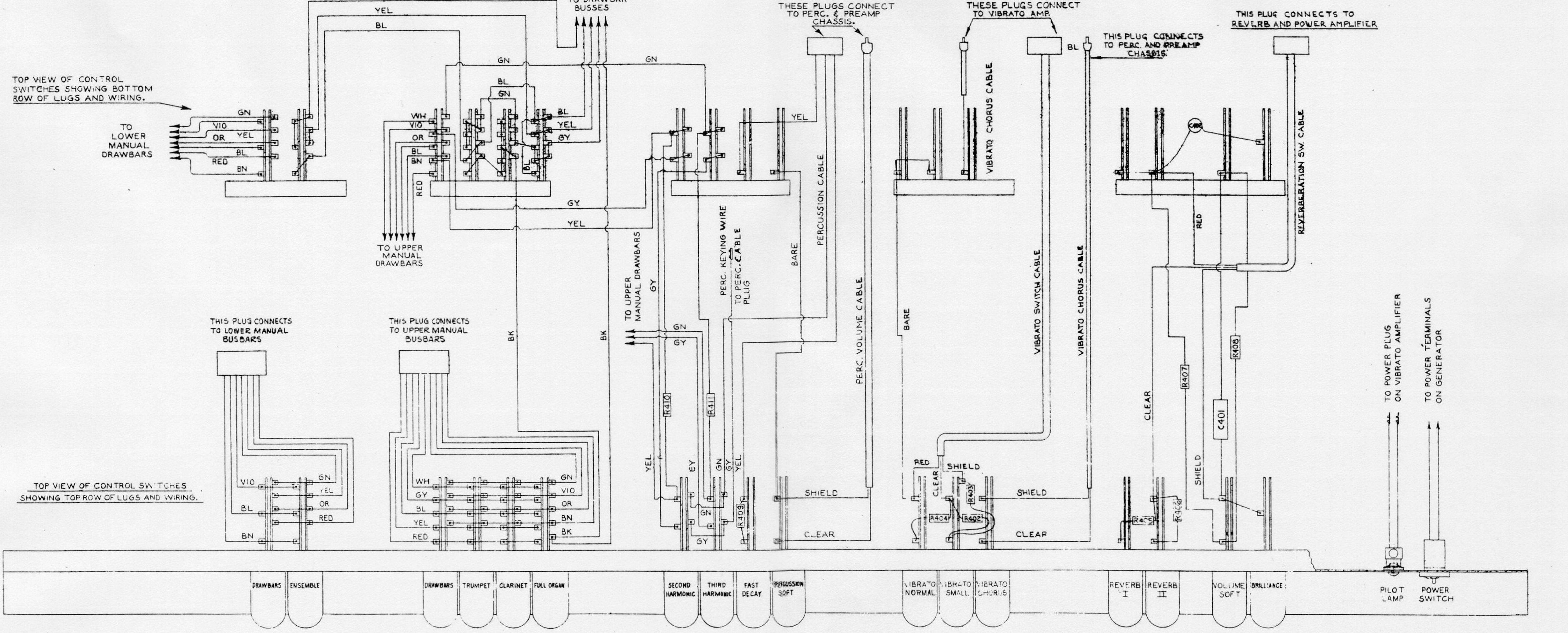


FIGURE 5–11.
WIRING DIAGRAM,
CONTROL PANEL, L–100 SERIE



MODEL L101 CONSOLES SERIAL NO.39474 AND ABOVE
MODEL L102 CONSOLES SERIAL NO.42527 AND ABOVE
MODEL L103 CONSOLES SERIAL NO.43095 AND ABOVE

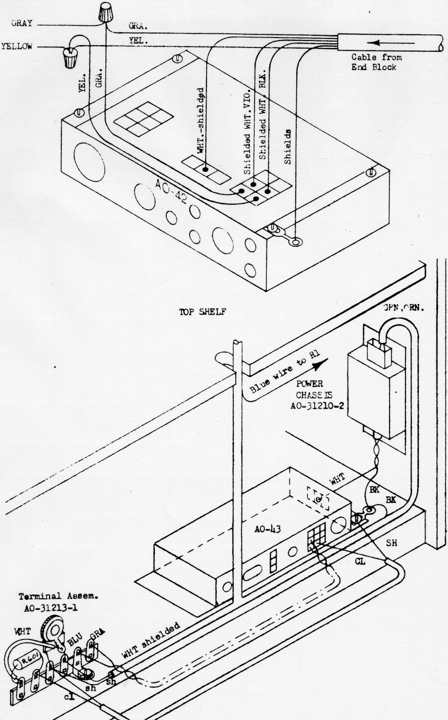
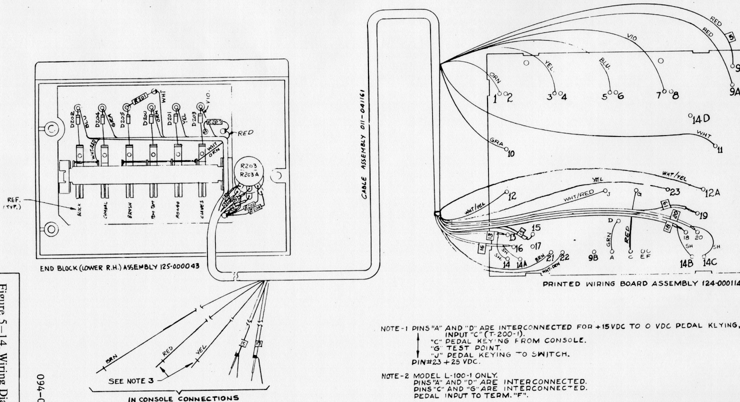


Figure 5–13. Wiring Diagram, Percussion Unit, L-100A



NOTE-1 PINS "A" AND "D" ARE INTERCONNECTED FOR +15VDC TO 0 VDC PEDAL KEYING, PEDAL INPUT "C" (T-200-1).
"C" PEDAL KEYING FROM CONSOLE.
"G" TEST POINT.
"J" PEDAL KEYING TO SWITCH.
PIN#23 +25 VDC.

NOTE-2 MODEL L-100-1 ONLY.
PINS "A" AND "D" ARE INTERCONNECTED.
PINS "C" AND "G" ARE INTERCONNECTED.
PEDAL INPUT TO TERM. "F".

094-041160 D

P.W.B. PIN FUNCTIONS:

PIN#1 TOM TOM KEYING.
2 TEST POINT.
3 BONGO KEYING.
4 TEST POINT.
5 BLOCK KEYING.
6 TEST PO
7 CLAVE KE NG
8 TEST POINT.
9, 9A, 9B: +15VDC
10 CYMBAL KEYING.
11 BRUSH KEYING.
12, 12A: +20VDC
13 HIGH FREQUENCY OUTPUT TO SWITCH
14, 14A, 14B, 14C & 14D: GROUND.
15 HIGH FREQUENCY OUTPUT TO CONSOLE
16 HIGH FREQUENCY RETURN FROM SWITCH.
17 NOT USED.
PIN#18 LOW FREQUENCY OUTPUT TO SWITCH.

PIN# 19 LOW FREQUENCY OUTPUT TO CONSOLE.
20 LOW FREQUENCY OUTPUT FROM SWITCH.
21 MANUAL KEYING IN.
PIN# 22 MANUAL KEYING OUT TO SWITCH.

Figure 5–14. Wiring Diagram, Six-Voice Percussion, L-100-1

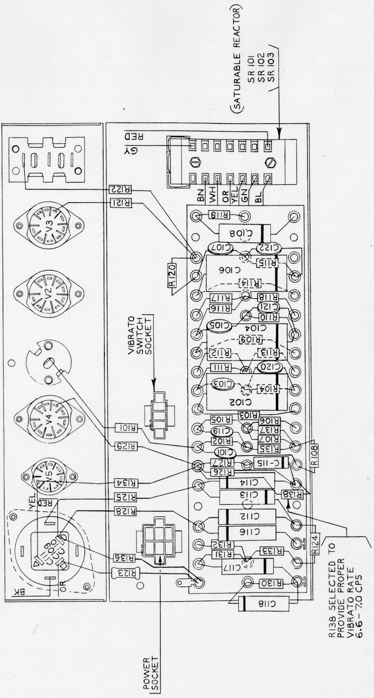


Figure 5–15. Parts Layout AO-41 Vibrato Amplifier

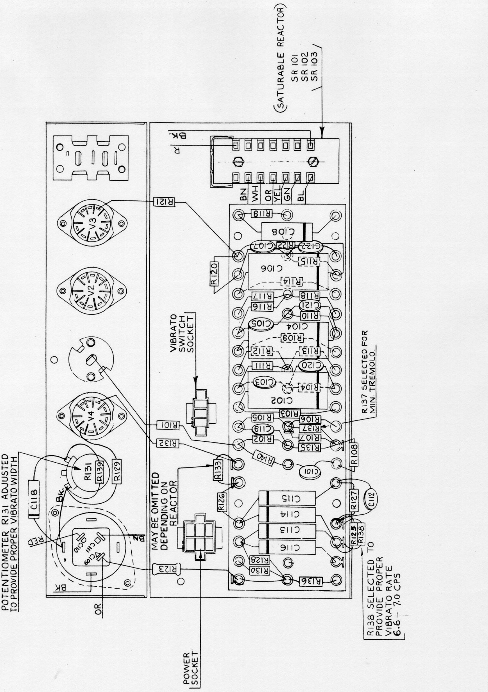


Figure 5–16. Parts Layout AO-47 (126-000023) Vibrato Amplifier

MODEL L101 CONSOLES SERIAL NO. 41622 AND ABOVE
MODEL L102 CONSOLES SERIAL NO. 42028 AND ABOVE
MODEL L103 CONSOLES SERIAL NO. 43102 AND ABOVE

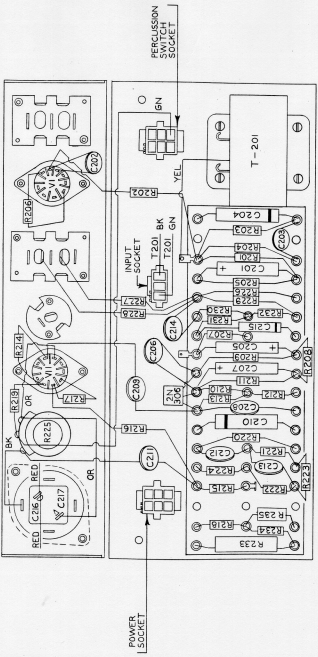


Figure 5–17. Parts Layout, AO-42 (117-000009) Percussion Amplifier

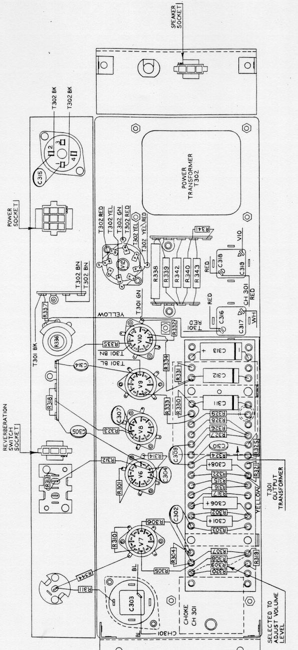


Figure 5–18. Parts Layout, AO-43 (126-000017) Power Amplifier

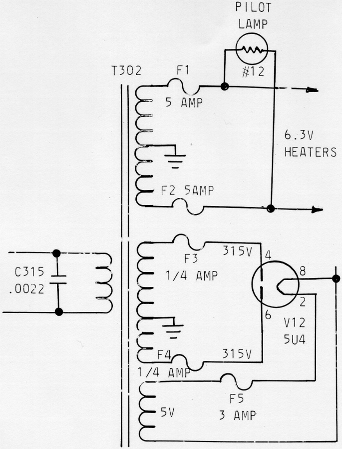


FIGURE 5–19
POWER AMPLIFIER FUSE
LOCATION (CANADIAN, 101-000130)

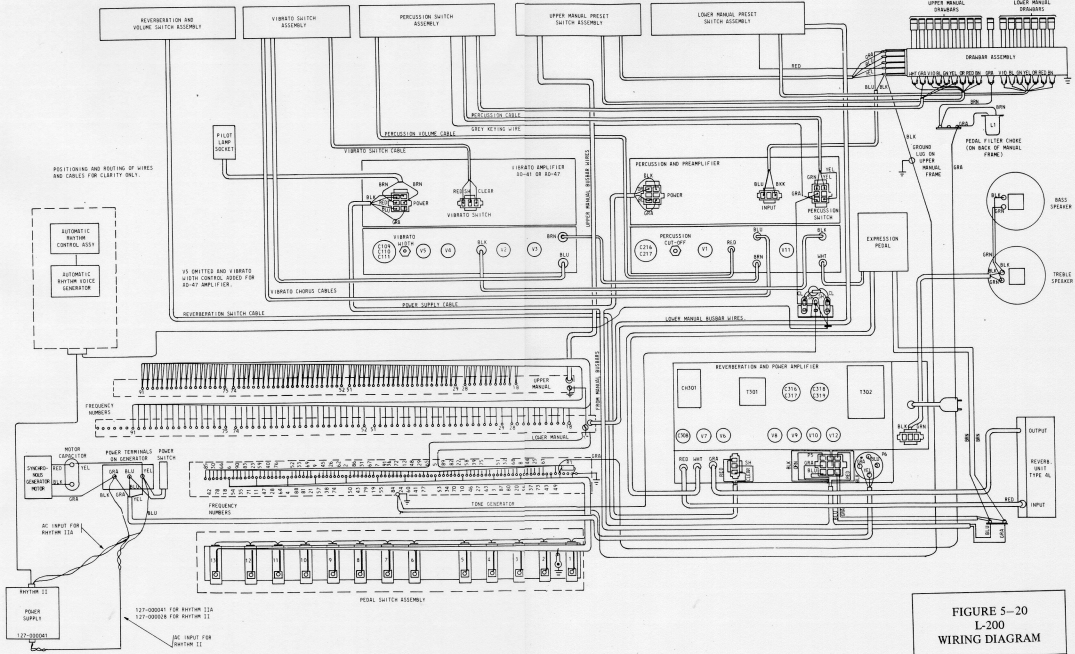


FIGURE 5–20
L-200
WIRING DIAGRAM

SECTION VI
L-SERIES PARTS LIST

INDEX

CONTROL PANEL ASSEMBLY 120-000011

Panel Assembly	061-027350
Stop Switch Base	041-025778
Screw (Stop Switch Base Mounting)	823-041714
"S" Clip (For Control Panel Switch Cover)	013-024298
Line Switch	008-034791
Lampholder Assembly	016-034440
Lamp 6.3V	016-022885
Pilot Light Lens	016-031454
Push on Clip (For Lens)	013-031468
Felt Washer	042-020820
Aluminum Foil Tape	039-031450
Shim (For Line Switch)	033-043006
Screw (Control Panel Mounting - 10 Used)	845-070318
Washer (Used on Control Panel Screws - 10 Used)	999-000061
Manual Stop Switch Assembly	120-000041
Mounting Block Assembly	063-025776
Contact Spring Assembly	012-027488
Stop Slide	028-032049
Stop Channel	025-027829
Drawbar Stop	025-040198
#4-24x3/8 Round Head Screw (Drawbar Knob Mounting)	901-030514
Stamped Stop Knob 16'	031-034331
Stamped Stop Knob 8'	031-034333
Stamped Stop Knob 5-1/3'	031-034337
Stamped Stop Knob 4'	031-034338
Stamped Stop Knob 2-2/3'	031-034339
Stamped Stop Knob 2'	031-034340
Stamped Stop Knob 1-3/5'	031-034341
Stamped Stop Knob 1-1/3'	031-034342
Stamped Stop Knob 1'	031-034343
Stop Knob - Black (Early Production Only)	025-035570
Stop Knob - Ivory (Early Production Only)	025-035571
Stop Knob - Brown (Early Production Only)	025-035572
Clamp Spring	012-027613
Terminal Lug	007-022320
Twisted Pair & Cap Assembly (Console Output to Preamplifier)	011-036624
#2 Binder Head Machine Screw (For Drawbar Stops)	846-010414

PRESET SWITCH ASSEMBLY (LOWER MANUAL) 008-024391

Switch Panel & Bracket Assembly	008-024614
Cancel Lever Assembly	060-037187
Mounting Bracket	035-024205
Lever Mounting Bracket	035-024335
Control Tab (Drawbars)	031-036481
Control Tab (Ensemble)	031-036482
Plastic Tie	013-031744
Tubular Clip	013-028002
Shaft	020-037240
Spring Washer	999-000151
Sems. Round Head Machine Screw	821-040314
Flat Head Machine Screw	839-040214

PRESET SWITCH ASSEMBLY (UPPER MANUAL) 008-024392

Switch Panel & Bracket Assembly (Drawbars, Trumpet, Clarinet)	008-024613
Switch Panel & Bracket Assembly (Full Organ)	008-024626
Cancel Linkage Assembly	060-037190

Mounting Bracket	035-024205
Lever Mounting Bracket	035-024335
Control Tab. (Drawbars)	031-036481
Control Tab. (Trumpet)	031-036483
Control Tab. (Clarinet)	031-036484
Control Tab. (Full Organ)	031-036485
Tubular Clip	013-028002
Shaft	020-037238
Spring Washer	999-000151
Terminal Lug	007-035151
Sems. Round Head Machine Screw	821-040314

PERCUSSION SWITCH ASSEMBLY 008-024393

SWITCH PANEL & BRACKET ASSEMBLY (SECOND HARMONIC, THIRD HARMONIC) 008-024615

SWITCH PANEL & BRACKET ASSEMBLY (FAST DECAY, PERCUSSION SOFT) 008-024617

Mounting Bracket			035-024205
Lever Mounting Bracket			035-024335
Control Tab (Second Harmonic)			031-036486
Control Tab (Third Harmonic)			031-036487
Control Tab (Fast Decay)			031-036488
Control Tab (Percussion Soft)			031-036489
Spring Washer			999-000151
Tubular Clip			013-028002
Shaft			020-037238
Terminal Lug			007-024137
Flat Head Machine Screw			839-040214
Sems. Round Head Machine Screw			821-040314
Resistor	2.2Meg	R409	600-021291
Resistor	4.7Ω	R410, R411	600-021561

VIBRATO SWITCH ASSEMBLY 008-024394

SWITCH PANEL & BRACKET ASSEMBLY (VIBRATO SMALL) 008-024616

SWITCH PANEL & BRACKET ASSEMBLY (VIBRATO NORMAL, VIBRATO CHORUS) 008-024617

Mounting Bracket			035-024205
Lever Mounting Bracket			035-024335
Control Tab. (Vibrato Normal)			031-036490
Control Tab. (Vibrato Small)			031-036491
Control Tab. (Vibrato Chorus)			031-036492
Plastic Tie			013-031744
Terminal Lug			007-024137
Shaft			020-037238
Tubular Clip			013-028002
Spring Washer			999-000151
Flat Head Machine Screw			839-040214
Resistor	2.2Meg	R403	600-021291
Resistor	3.9Meg	R404	600-021351
Resistor	6.8Meg	R402	600-021411

REVERBERATION, VOLUME, BRILLIANCE SWITCH ASSEMBLY 008-025549

Switch Panel & Bracket Assembly (Reverb II Volume Soft)	008-024617

Switch Panel & Bracket Assembly (Reverb I)	008-024604
Switch Panel & Bracket Assembly (Brilliance)	008-024610
Mounting Bracket	035-024351
Lever Mounting Bracket	035-024335
Control Tab. (REVERB I)	031-036493
Control Tab. (REVERB II)	031-036494
Control Tab. (VOLUME SOFT)	031-036495
Control Tab. (BRILLIANCE)	031-036496
Plastic Tie	013-031744
Shaft	020-037239
Spring Washer	999-000151
Tubular Clip	013-028002
Tie Strap	041-027176
Flat Head Machine Screw	839-040314
Sems. Round Head Machine Screw	821-040314
Resistor 100K R407	600-020971
Resistor 270K R406	600-021071
Resistor 820K R405	600-021191
Resistor 4.7Meg. R408	600-021371
Capacitor Ceramic .0015μf C402	425-010542
Capacitor .022μf C401	401-020342
Shielded Lead Assembly (Vibrato Chorus Cable - Blue Plug)	011-034752
Shielded Lead Assembly (Percussion Volume Cable - Red Plug)	011-034753
Shielded Cable & Cap assembly (Vibrato Switch Cable)	011-036621
Shielded Cable & Cap Assembly (Reverb Switch Cable)	011-036622

PERCUSSION CABLE ASSEMBLY (PERCUSSION CABLE) 011-036640

CABLE ASSEMBLY (LOWER MANUAL PLUG) 011-036749

CABLE ASSEMBLY (UPPER MANUAL PLUG) 011-036750

LOWER MANUAL ASSEMBLY 119-000045

UPPER MANUAL ASSEMBLY 119-000009

Switch Cover Assembly	060-033397
Top Cover Assembly	060-033405
Key Comb Assembly (12 Keys)	057-045053
Key Comb Assembly (8 Keys)	057-045052
Key & Channel Assembly (Sharp Key)	060-024286
Key & Channel Assembly (One Set of Seven Ivory)	057-042770
Bracket & Channel Assembly	060-033392
Sems. Bind Head Machine Screw	850-000002
Sharp Key - Black	025-032672
Natural Key - Ivory "C"	025-042279
Natural Key - Ivory "D"	025-042280
Natural Key - Ivory "E"	025-045053
Natural Key - Ivory "F"	025-042282
Natural Key - Ivory "G"	025-042283
Natural Key - Ivory "A"	025-042284
Natural Key - Ivory "B"	025-042285
Natural Key - Ivory "CX" (Last Key on Manual)	025-042286
Mounting Bracket Left Hand	060-040192
Mounting Bracket Right Hand	060-040193
Strain Relief	013-034999
Screw (Key Comb)	831-070314
Screw (Top Cover)	925-050314
Screw (Switch Top Cover)	831-070414

GENERATOR & MOTOR ASSEMBLY

Generator & Motor Assembly	120V	60Hz	112-000021
Generator & Motor Assembly	120V	50Hz	112-000022
Generator & Motor Assembly	220V	60Hz	112-000023
Generator & Motor Assembly	220V	50Hz	112-000024
Generator Assembly		60Hz	113-000011
Generator Assembly		50Hz	113-000012
Synchronous Motor	120V	60Hz	021-033801
Synchronous Motor	120V	50Hz	021-033802
Synchronous Motor	220V	60Hz	021-033803
Synchronous Motor	220V	50Hz	021-033804
Motor Capacitor	120V	60Hz	499-033806
Motor Capacitor	120V	60Hz or 120V 50Hz	499-033807
Motor Capacitor	220V	60Hz or 220V 50Hz	499-033805
Generator Cover Assembly			115-000031
Terminal Panel Assembly (AC Panel with GY, BL. YEL.)			006-024326
Motor Mounting Bracket			035-027354
Capacitor Clamp			013-024313
Motor Clamp			013-024427
Motor Coupling Spring			012-029132
Motor Coupler			017-024242
Insulator Strip (AC Panel)			036-024328
Post (For Mounting Cover)			044-031434
Terminal Cover			041-022076
Oval End Cap (Motor Capacitor)			041-024838

PEDAL KEYBOARD & SWITCH ASSEMBLY 116-000010

Pedal Keyboard Frame Assembly		060-024270
Cover Assembly		046-025208
Cable Assembly		011-024210
Actuator	(13 Used)	045-024198
Extension Spring	(13 Used)	012-020404
Stop Post	(13 Used)	044-020398
Up Stop Felt	(26 Used)	042-020410
Down Stop Felt		042-031898
Terminal Lug		007-015197
Pivot Bracket	(8 Used)	035-036094
Pivot Bracket	(5 Used)	035-036095
Terminal Panel Assembly (Long)		063-036553
Terminal Panel		045-024196
Stationary Contact Assembly	(8 Used)	030-033305
Contact Spring Assembly	(8 Used)	012-033541
Actuator Spring	(8 Used)	012-024199
Eyelet	(24 Used)	999-026552
Terminal Panel Assembly (Short)		063-036542
Terminal Panel		006-024197
For Other Components, Refer to Long Panel Assembly.		
Key Channel Assembly (Long)		057-035978
Key Channel (Long)		041-020402
Long Key (Brown)		025-031666
Guide Felt		042-021255
Eyelet		999-017454
Sems. Bind Head Machine Screw (Mounting Key)		850-100514
Key Channel Assembly (Short)		057-035982
Key Channel (Short)		041-020403
Short Key (Black)		025-031469
Guide Felt		042-021255
Eyelet		999-017454
Sems. Bind Head Machine Screw (Mounting Key)		850-100714

PREAMPLIFIER ASSEMBLY 117-000009 (AO-42)

Chassis Pan Assembly				009-024416
Chassis Housing Assembly				009-024417
Matching Transformer Assembly T201				003-024469
Plug Assembly	3 Pin			011-036632
Plug Assembly	6 Pin (Power)			011-024376
Plug Assembly	6 Pin (Percussion Switch)			011-036637
Tube 12AU7				002-012300
Tube 12AX7				002-012301
Tube Shield				010-041481
Set of Capacitors & Resistors (Chassis Mounted)				063-024412
Resistor	270K	R206		600-021071
Resistor	1Meg	R214		600-021211
Resistor	330K	R217		600-021091
Potentiometer	30K	R225		676-000144
Resistor & Capacitor Panel Assembly				063-024414
Terminal Board				006-024407
Resistor	68K	R212, R229		600-040931
Resistor	390Ω	R211		600-020391
Resistor	20K	R233		626-060861
Resistor	2.7K	R235		600-030591
Resistor	3.9Meg	R219		600-021351
Resistor	82Ω	R209		600-020231
Resistor	100Ω	R207		600-020251
Resistor	220Ω	R234		600-020331
Resistor	1K	R208		600-020491
Resistor	1.2K	R231		600-020511
Resistor	3.3K	R205		600-020611
Resistor	4.7K	R210, R215, R216		600-020651
Resistor	15K	R213		600-020771
Resistor	47K	R202, R221, R232		600-020891
Resistor	100K	R220, R223		600-020971
Resistor	150K	R224		600-021011
Resistor	180K		Selected for	600-021031
Resistor	220K	R226	Proper Gain	600-021051
Resistor	270K		at Inspection	600-021071
Resistor	270K	R222		600-021070
Resistor	330K	R218		600-021011
Resistor	470K	R228, R230		600-021131
Resistor	680K	R227		600-021171
Resistor	1Meg	R201		600-021211
Resistor	4.7Meg	R203	Selected at	600-021371
Resistor	5.6Meg		Time of	600-021391
Resistor	120K	R236	Inspection	600-020991
Capacitor	.1 mfd	200V	C215	401-020533
Capacitor	.047 mfd	400V	C204	403-030452
Capacitor	.33 mfd	100V	C210	406-010172
Capacitor	100 mfd	3V	C201, C205, C207	407-010029
Capacitor	39 pf	500V	C203	425-010151
Capacitor	.0047 mfd	100V	C211	413-010042
Capacitor	.01 mfd	100V	C208, C209, C213, C214	413-010072
Capacitor	.02 mfd	100V	C212	425-010763
Capacitor	.1 mfd	10V	C206	427-030025
Transistor			Q201	001-021070

VIBRATO AMPLIFIER ASSEMBLY 126-000023 (AO-47)

Chassis Pan Assembly	009-036649
Chassis Housing Assembly	009-024417

Description	Value	Voltage	Circuit Ref.	Remarks	Part No.
Saturable Reactor Assembly					063-025246
Plug Assembly	3 Pin				011-036630
Plug Assembly	6 Pin				011-024376
Capacitor	30 mfd/350V, 40 mfd/450V, 40 mfd/400V		C109, C110, C111		450-040200
Potentiometer	500K		R131		676-000152
Tube	7247				002-006307
Tube	12AU7				002-012300
Tube Shield					010-041481
Terminal Board Assembly (Resistor & Capacitor)					063-027083
Terminal Board					006-036647
Resistor	5K		R123		603-060761
Resistor	56K		R136		600-030911
Resistor	10K		R103, R107, R113, R114, R118, R109		600-030732
Resistor	470Ω		R106, R112, R117		600-020411
Resistor	560Ω		R133....Use With Red Dot Reactors		600-020431
Resistor	1K		R132		600-020491
Resistor	1.2K		R121		600-020511
Resistor	8.2K		R122		600-020711
Resistor	15K		R104, R110, R115		600-020771
Resistor	47K		R119		600-020891
Resistor	180K		R102		600-021031
Resistor	220K		R101		600-021051
Resistor	330K		R135		600-021091
Resistor	470K		R130, R125, R126, R127		600-021131
Resistor	1Meg		R120, R139, R105, R111, R116		600-021211
Resistor	1.8Meg		R108		600-021271
Resistor	1.2K 5%		R129		600-020512
Resistor	150K 5%		R128		600-021012
Resistor	12K		R137	One Resistor Selected at Factory For Proper Phase Shift	600-020751
Resistor	15K		R137		600-020771
Resistor	18K		R137		600-020791
Resistor	22K		R137		600-020811
Resistor	27K		R137		600-020831
Resistor	33K		R137		600-020851
Resistor	1.2Meg		R138	One Resistor Selected at Factory For Proper Vibrato Rate 6.6-7.0 Hz.	600-021231
Resistor	1.5Meg		R138		600-021251
Resistor	1.8Meg		R138		600-021271
Resistor	2.2Meg		R138		600-021291
Resistor	2.7Meg		R138		600-021311
Resistor	3.3Meg		R138		600-021331
Resistor	3.9Meg		R138		600-021351
Resistor	270Ω		R133	One Resistor Selected at Factory For Proper Width Control	600-020351
Resistor	330Ω		R133		600-020371
Resistor	390Ω		R133		600-020391
Resistor	470Ω		R133		600-020411
Resistor	560Ω		R133		600-020431
Capacitor	.047 mfd	100V	C118		406-010112
Capacitor	.02 mfd	100V	C114, C115		406-010182
Capacitor	.02 mfd	400V	C113		422-032012
Capacitor	.047 mfd	400V	C108		422-032022
Capacitor	.10 mfd	400V	C116		422-032032
Capacitor	.47 mfd	400V	C102, C104, C106		422-032092
Capacitor	150 pf	500V	C120, C121, C122		425-010292
Capacitor	.001 mfd	500V	C101		425-010502
Capacitor	.0018 mfd	500V	C112		425-010562
Capacitor	.01 mfd	500V	C103, C105, C107, C119		425-010752

POWER AMPLIFIER ASSEMBLIES

Power Amplifier Assembly	**120V**	**60Hz**	**(AO-43-1)**		**126-000017**
Power Amplifier Assembly	**120V**	**50Hz**	**(AO-43-2)**		**126-000018**
Power Amplifier Assembly	**234V**	**50-60Hz**	**(AO-43-3)**		**126-000019**
Chassis Pan Assembly					**009-024410**
Power Transformer Assembly	**120V**	**60Hz**	**T-302**		**003-024157**
Power Transformer Assembly	**120V**	**50Hz**	**T-302**		**003-036548**
Power Transformer Assembly	**234V**	**50-60Hz**	**T-302**		**003-036549**
Output Transformer Assembly			**T-301**		**003-036550**
Filter Choke Assembly	**14 Henery**		**CH-301**		**003-024159**
AC Cord & Plug Assembly					**011-033233**
AC Strain Relief					**013-034998**
Plug Assembly	**3 Pin Female (Output)**				**011-036628**
Plug Assembly	**9 Pin**				**011-024379**
Plug Assembly	**3 Pin Female (Reverb)**				**011-036633**
Tube	**12BH7**	**V7**			**002-012302**
Tube	**12AX7**	**V6, V8**			**002-012301**
Tube	**6BQ5**	**V9, V10**			**002-006700**
Tube	**5U4**	**V12**			**002-005201**
Set of Capacitors & Resistors (Chassis Mounted)					**063-024401**
Resistor	**64Ω**	**R338**			**604-070071**
Resistor	**4.7K**	**R335**			**600-030651**
Resistor	**8.2K**	**R341**			**600-030711**
Resistor	**390Ω**	**R310, R314**			**600-020391**
Resistor	**1K**	**R311, R312**			**600-020491**
Resistor	**3.9K**	**R337**			**600-020631**
Resistor	**47K**	**R313, R323**			**600-020891**
Resistor	**470K**	**R301**			**600-021131**
Resistor	**4.7Meg**	**R318**			**600-021371**
Resistor	**220K**	**R344**			**600-021051**
Resistor	**300Ω**	**R339**			**602-050081**
Resistor	**750Ω**	**R340**			**602-050121**
Resistor	**1K**	**R343**			**602-050141**
Resistor	**130Ω**	**R332**			**606-050022**
Resistor	**33K**	**R309**	**Factory Selected For Nominal Gain**		**600-020851**
Resistor	**39K**	**R309**	**Factory Selected For Nominal Gain**		**600-020871**
Resistor	**56K**	**R309**	**Factory Selected For Nominal Gain**		**600-020911**
Resistor	**82K**	**R309**	**Factory Selected For Nominal Gain**		**600-020951**
Resistor	**120K**	**R309**	**Factory Selected For Nominal Gain**		**600-020991**
Resistor	**270K**	**R309**	**Factory Selected For Nominal Gain**		**600-021071**
Capacitor	**100pf**	**500V**	**C307**		**425-010252**
Capacitor	**.0022 mfd**	**500V**	**C315**		**425-010583**
Capacitor	**.0012 mfd**	**500V**	**C304**		**425-010522**
Capacitor	**.02 mfd**	**500V**	**C305**		**425-010763**
Capacitor	**.001 mfd**	**2000V**	**C314**		**425-030503**
Capacitor	**50 mfd**	**450V**	**C303**		**450-010070**
Capacitor	**50 mfd/450V**	**50 mfd/450V**	**C316, C317, C318, C319**		**450-040401**
Capacitor	**.001 mfd**	**500V**	**C320**		**425-010502**
Resistor & Capacitor Panel Assembly					**063-024411**
Resistor	**150Ω**	**R321**			**600-020291**
Resistor	**1K**	**R333, R334**			**600-020491**
Resistor	**2.7K**	**R302, R327**			**600-020591**
Resistor	**6.8K**	**R322**			**600-020691**
Resistor	**10K**	**R305, R306**			**600-020731**
Resistor	**39K**	**R308**			**600-020871**
Resistor	**47K**	**R325**			**600-020891**
Resistor	**68K**	**R315**			**600-020931**
Resistor	**100K**	**R316, R317, R328, R329**			**600-020971**

Resistor	150K	R320		600-021011
Resistor	180K	R304		600-021031
Resistor	220K	R303, R319		600-021051
Resistor	330K	R307, R330, R331		600-021091
Resistor	470K	R324		600-021131
Resistor	1Meg	R326		600-021211
Capacitor	.047 mfd	400V	C311, C312	403-030452
Capacitor	100 mfd	3V	C301, C308	407-010029
Capacitor	220 pf	500V	C310	425-010332
Capacitor	.02 mfd	500V	C302, C309	425-010763
Capacitor	5 mfd	150V	C306	450-040083
Capacitor	100 mfd	25V	C313	450-040084
Potentiometer	10K	R336		676-000143

PERCUSSION PRESET ASSEMBLY (L-100A) 121-000105

Printed Circuit Board Chassis	121-000102
Power Supply Chassis	121-000103
Speaker Assembly	121-000104
Marked Endblock	025-031201
Knob Large (Percussion Endblock)	031-033591
Knob Small (Percussion Endblock)	031-033594

RHYTHM PRINTED WIRING BOARD ASSEMBLY 124-000114

Used With 6-Button Rhythm Endblock

Printed Wiring Board				023-041242
Resistor	470Ω	R138		600-020411
Resistor	820Ω	R103, R103A, R103B, R103C		600-020471
Resistor	2200Ω	R141, R160		600-020571
Resistor	5600Ω	R130		600-020671
Resistor	10K	R108, R108A, R108B, R125, R131, R157, R161, R164		600-020731
Resistor	12K	R148		600-020751
Resistor	15K	R106A		600-020772
Resistor	15K	R119, R122		600-020771
Resistor	18K	R107B		600-020791
Resistor	22K	R106, R106B, R106C, R107C		600-020812
Resistor	22K	R140, R128, R150, R151, R154, R159		600-020811
Resistor	27K	R114, R127, R142		600-020831
Resistor	33K	R118, R145		600-020851
Resistor	39K	R107A		600-020872
Resistor	47K	R100, R100A, R100B, R100C, R137, R136, R139		600-020891
Resistor	68K	R102, R102A, R102B, R102C, R165		600-020932
Resistor	100K	R101, R101A, R101B, R101C, R110, R117, R152, R153, R155, R156		600-020971
Resistor	150K	R121, R163		600-021011
Resistor	220K	R123, R147, R149, R158, R160		600-021051
Resistor	150Ω	R167		600-020291
Resistor	470K	R105, R105A, R105B, R105C, R111, R115, R120, R162		600-021131
Resistor	680K	R124		600-021171
Resistor	1Meg	R112		600-021211
Resistor	2.2Meg	R104, R104A, R109, R109A, R109B, R109C		600-021291
Resistor	2.7Meg	R129		600-021311
Resistor	6.8Meg	R104B, R168		600-021411
Resistor	10Meg	R104C		600-021451
Resistor	1.5Meg	R116		600-021251
Resistor	27K	R107		600-020832
Potentiometer Trimmer	5K	R134		676-000011
Potentiometer Trimmer	50K	R113, R126		676-000019
Potentiometer Trimmer	20K	R169		676-000015

Capacitor	.001 mfd	C110, C117, C118, C119	405-340012
Capacitor	.0015 mfd	C102C, C103C; C104C	405-340022
Capacitor	.0022 mfd	C121, C125	405-340032
Capacitor	.0039 mfd	C115	405-340052
Capacitor	.0047 mfd	C102B, C103B, C104B, C128	405-340062
Capacitor	.0082 mfd	C109	405-340072
Capacitor	.01 mfd	C108, C111, C112, C116, C130	405-340082
Capacitor	.015 mfd	C102A, C103A, C104A	405-340092
Capacitor	.022 mfd	C101B, C102, C103, C104	405-340112
Capacitor	.047 mfd	C101, C101A, C127	405-340142
Capacitor	.1 mfd	C100, C100A, C100B, C100C, C108, C107, C114, C123, C124, C126	405-340182
Capacitor	.22 mfd	C113	405-340212
Capacitor	.056 mfd	C101C	405-340162
Capacitor	47pf	C105B	426-010172
Capacitor	68pf	C105C	426-010212
Capacitor	220pf	C105, C105A	426-010332
Capacitor Tantalum	1mfd	C120	414-040092
Capacitor Tantalum	10mfd	C122	414-040152
Capacitor Electrolytic	1000mfd	C129	407-060149
Transistor		Q106, Q107, Q108	001-021070
Transistor		Q100, Q100A, Q100B, Q100C, Q103, Q104, Q112, Q114, Q115, Q116	001-021134
Transistor		Q102, Q105, Q109, Q110	001-021135
Transistor		Q111, Q113	001-021172
Transistor	(Noise)	Q101	001-021211
Diode		D100, D100A, D100B, D100C, D101, D102, D103, D104	001-026010
Choke		L100, L101	003-030753

LOWER RIGHT HAND ENDBLOCK ASSEMBLY 125-000043

(Rhythm Six-Button T-200-1-2, T-400)

Endblock Lower Right Hand		025-041129
Cushion		043-041131
Push Button		025-033453
Compression Spring		012-033464
Knob		031-031755
Cable Assembly		011-041161
Cable Clip		013-025297
Potentiometer (Duel Construction)		676-000269
Resistor	2200Ω	600-010571
Resistor	10K	600-010731
Resistor	56K	600-020911
Diode		001-026010
Switch Panel Assembly		008-041158
Switch Panel		006-041135
Contact Spring Assembly		008-021944
Stationary Contact Assembly		030-021927
Riveting Plate		041-020664
Contact Spring		030-041132
Pivot Bracket		041-041133
Felt Stop		042-041130
Stop Post		030-033690
Spring		012-032408
Shaft		020-037239
Spring Bridge		041-041134
Support (Shaft)		041-041157
Rocker Tab	Block Pedal	031-041143
Rocker Tab	Cymbal Pedal	031-041144
Rocker Tab	Brush Lower	031-041145

Rocker Tab	Bongo Lower			031-041146
Rocker Tab	Tom Tom Lower			031-041147
Rocker Tab	Claves Lower			031-041148
Felt Washer				042-032415
Retaining Ring (For Shaft)				013-041163
Terminal Lug				007-022974

POWER SUPPLY ASSEMBLY 120V 60Hz 127-000007

POWER SUPPLY ASSEMBLY 120V 50Hz 127-000008

POWER SUPPLY ASSEMBLY 220V 50-60Hz 127-00009

Power Supply Chassis				041-033661
Terminal Strip Assembly				006-028913
Transformer	120V	60Hz		003-033473
Transformer	120-220V	50-60Hz		003-033474
Capacitor Electrolytic	500mfd			407-090329
Capacitor Electrolytic	80mfd/40mfd/20mfd		C100	450-070050
Printed Wiring Board Assembly				124-000022
Printed Wiring Board & Pin Assembly				023-033482
Diode	D100, D101, D102, D103			001-024051
Transistor	Q100, Q101			001-021133
Transistor	Q102			001-021111
Zener Diode	30V	D104		001-023040
Resistor	150Ω	R103		600-020291
Resistor	220Ω	R101		600-020331
Resistor	330Ω	R102		600-020371
Resistor	2.2K	R104		600-020571
Resistor	6.8K	R105		600-020692
Resistor	27K	R106		600-020832
Resistor	33K	R108		600-020852
Capacitor Ceramic	.02mfd	C102		426-010763
Spacer	(4 Used)			044-033662
Cable Assembly				011-040032

PEDAL CONTROL BOARD ASSEMBLY (ENDBLOCK RHYTHM)

Pedal Control Board Assembly			063-042051
Terminal Board Assembly			006-041578
Capacitor	1 mfd	C1	414-040092
Capacitor	.1 mfd	C2, C3, C4	414-040012
Capacitor	390 pf	C5	425-010392
Capacitor	82 pf	C6	425-010232
Capacitor	470 pf	C7	425-010412
Resistor	1000Ω	R1	600-020491
Resistor	2200Ω	R16	600-020571
Resistor	10K	R5, R10	600-020731
Resistor	15K	R12, R15	600-020771
Resistor	22K	R11	600-020811
Resistor	100K	R3, R4, R7	600-020971
Resistor	150K	R6	600-021011
Resistor	470K	R7	600-021131
Resistor	1Meg	R13, R14	600-021211
Resistor	2.2Meg	R8	600-021291
Resistor	3.9Meg	R2	600-021351
Transistor	Q2, Q4		001-021133
Transistor	Q1, Q3		001-021135
Diode	D1		001-026030

AUTOMATIC RHYTHM ASSEMBLY (RHYTHM II DRAWER)

Automatic Rhythm Assembly	120V	60Hz	110-000047
Power Supply Assembly			127-000028
Automatic Rhythm Assembly	120V	50Hz	110-000049
Power Supply Assembly			127-000029
Automatic Rhythm Assembly	220V	60Hz	110-000050
Power Supply Assembly			127-000030
Automatic Rhythm Assembly	220V	50Hz	110-000051
Power Supply Assembly			127-000030
Shield (Power Supply)			010-042054
Control Assembly			125-000045
Voice Generator Assembly			063-042080
Shield (Voice Generator Assembly)			010-042082
Wire & Plug Assembly			011-042083
Screw #6 (4 Power Supply-4 Voice Generator)			884-050734
Screw (Mounting Rail)			884-050933
Adhesive Backed Felt			042-035141
Washer			999-000065
Clip (Adhesive Backed)			013-042242

WOODWORK

Cabinet Assembly	L111-1	111-000024
Case Assembly		050-036894
Top Panel		050-036890
Music Panel		050-038294
Baffel & Grille Cloth		052-036886
Rear Cover		056-040229
Bench Assembly		152-000023
Cabinet Assembly	L112-1	111-000025
Case Assembly		050-036895
Top Panel		050-036891
Music Panel		050-038295
Baffel & Grille Cloth		052-036887
Rear Cover		056-040228
Bench Assembly		152-000024
Cabinet Assembly	L122-1	111-000026
Case Assembly		050-025470
Top Panel		050-036891
Music Panel		050-025427
Baffel & Grille Cloth		052-036887
Rear Cover		056-040228
Bench Assembly		152-000027
Cabinet Assembly	L133-1	111-000027
Case Assembly		050-025500
Top Panel		050-036893
Music Panel		050-025428
Baffel & Grille Cloth		052-036888
Rear Cover		056-040228
Bench Assembly		152-000025
Cabinet Assembly	L143-1	111-000028
Case Assembly		050-025530
Top Panel		050-036892
Music Panel		050-036905
Baffel & Grille Cloth		052-036889
Rear Cover		056-040230
Bench Assembly		152-000026
Cabinet Assembly	L212-1	111-000115

Case Assembly		050-036895
Top Panel		050-000840
Music Panel		050-038295
Baffel & Grille Cloth		052-036887
Rear Cover		056-040228
Bench Assembly		152-000024
Cabinet Assembly	L222-1	111-000116
Case Assembly		050-025470
Top Panel		050-000840
Music Panel		050-025427
Baffel & Grille Cloth		052-036887
Rear Cover		056-040228
Bench Assembly		152-000027

MISCELLANEOUS

Pedal Filter Choke Assembly	003-025333
Cable Assembly (Generator To Manuals)	011-024352
Reverberation Unit Assembly	121-000002
Trim Strip (Grille Cloth)	061-031029
Speed Nut	999-024841
Cover (Control Switch)	041-024211
Felt (Adhesive Backed)	042-033312
Endblock Upper Right Hand - Textured	025-035707
Endblock Upper Right Hand - Smooth	025-024307
Endblock Lower Left Hand - Textured	025-028406
Endblock Lower Left Hand - Smooth	025-024848
Endblock Lower Right Hand - Textured	025-028407
Endblock Lower Right Hand - Smooth	025-024847

SPEAKERS

L100, L100-1,-2	(Early Production)	014-024346
		014-027293
L100A	(Early Production)	014-024346
		014-024347
L100, L100-1,-2		014-030812
		014-027293
L100A		014-030812
		014-024347

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CONTROL PANEL ASSEMBLY 120-000011

Panel Assembly	061-027350
Stop Switch Base	041-025778
Screw (Stop Switch Base Mounting)	823-041714
"S" Clip (For Control Panel Switch Cover)	013-024298
Line Switch	008-034791
Lampholder Assembly	016-034440
Lamp 6.3V	016-022885
Pilot Light Lens	016-031454
Push on Clip (For Lens)	013-031468
Felt Washer	042-020820
Aluminum Foil Tape	039-031450
Shim (For Line Switch)	033-043006
Screw (Control Panel Mounting - 10 Used)	845-070318
Washer (Used on Control Panel Screws - 10 Used)	999-000061
Manual Stop Switch Assembly	120-000041
Mounting Block Assembly	063-025776
Contact Spring Assembly	012-027488
Stop Slide	028-032049
Stop Channel	025-027829
Drawbar Stop	025-040198
#4-24x3/8 Round Head Screw (Drawbar Knob Mounting)	901-030514
Stamped Stop Knob 16'	031-034331
Stamped Stop Knob 8'	031-034333
Stamped Stop Knob 5-1/3'	031-034337
Stamped Stop Knob 4'	031-034338
Stamped Stop Knob 2-2/3'	031-034339
Stamped Stop Knob 2'	031-034340
Stamped Stop Knob 1-3/5'	031-034341
Stamped Stop Knob 1-1/3'	031-034342
Stamped Stop Knob 1'	031-034343
Clamp Spring	012-027613
Terminal Lug	007-022320
Twisted Pair & Cap Assembly (Console Output to Preamplifier)	011-036624
#2-56 Tap Tite Screw	939-010434

PRESET SWITCH ASSEMBLY (LOWER MANUAL) 008-034391

Switch Panel & Bracket Assembly	008-024614
Cancel Lever Assembly	060-037187
Mounting Bracket	035-024205
Lever Mounting Bracket	035-024335
Control Tab (Drawbars)	031-036481
Control Tab (Ensemble)	031-036482
Plastic Tie	013-031744
Tubular Clip	013-028002
Shaft	020-037240
Spring Washer	999-000151
Sems. Round Head Machine Screw	821-040314
Flat Head Machine Screw	839-040214

PRESET SWITCH ASSEMBLY (UPPER MANUAL) 008-024392

Switch Panel & Bracket Assembly (Drawbars, Trumpet, Clarinet)	008-024613
Switch Panel & Bracket Assembly (Full Organ)	008-024626
Cancel Linkage Assembly	060-037190

Mounting Bracket	035-024205
Lever Mounting Bracket	035-024335
Control Tab. (Drawbars)	031-036481
Control Tab. (Trumpet)	031-036483
Control Tab. (Clarinet)	031-036484
Control Tab. (Full Organ)	031-036485
Tubular Clip	013-028002
Shaft	020-037238
Spring Washer	999-000151
Terminal Lug	007-035151
Sems. Round Head Machine Screw	821-040314

PERCUSSION SWITCH ASSEMBLY 008-024393

SWITCH PANEL & BRACKET ASSEMBLY (SECOND HARMONIC, THIRD HARMONIC) 008-024615

SWITCH PANEL & BRACKET ASSEMBLY (FAST DECAY, PERCUSSION SOFT) 008-024617

Mounting Bracket			035-024205
Lever Mounting Bracket			035-024335
Control Tab (Second Harmonic)			031-036486
Control Tab (Third Harmonic)			031-036487
Control Tab (Fast Decay)			031-036488
Control Tab (Percussion Soft)			031-036489
Spring Washer			999-000151
Tubular Clip			013-028002
Shaft			020-037238
Terminal Lug			007-024137
Flat Head Machine Screw			839-040214
Sems. Round Head Machine Screw			821-040314
Resistor	2.2 Meg	R409	600-021291
Resistor	4.7Ω	R410, R411	600-021561

VIBRATO SWITCH ASSEMBLY 008-024394

SWITCH PANEL & BRACKET ASSEMBLY (VIBRATO SMALL) 008-024616

SWITCH PANEL & BRACKET ASSEMBLY (VIBRATO NORMAL, VIBRATO CHORUS) 008-024617

Mounting Bracket			035-024205
Lever Mounting Bracket			035-024335
Control Tab. (Vibrato Normal)			031-036490
Control Tab. (Vibrato Small)			031-036491
Control Tab. (Vibrato Chorus)			031-036492
Plastic Tie			013-031744
Terminal Lug			007-024137
Shaft			020-037238
Tubular Clip			013-028002
Spring Washer			999-000151
Flat Head Machine Screw			839-040214
Resistor	2.2Meg	R403	600-021291
Resistor	3.9Meg	R404	600-021351
Resistor	6.8Meg	R402	600-021411

REVERBERATION, VOLUME, BRILLIANCE SWITCH ASSEMBLY 008-025549

Switch Panel & Bracket Assembly (Reverb II Volume Soft)	008-024617

Switch Panel & Bracket Assembly (Reverb I)	008-024604
Switch Panel & Bracket Assembly (Brilliance)	008-024610
Mounting Bracket	035-024351
Lever Mounting Bracket	035-024335
Control Tab. (REVERB I)	031-036493
Control Tab. (REVERB II)	031-036494
Control Tab. (VOLUME SOFT)	031-036495
Control Tab. (BRILLIANCE)	031-036496
Plastic Tie	013-031744
Shaft	020-037239
Spring Washer	999-000151
Tubular Clip	013-028002
Tie Strap	041-027176
Flat Head Machine Screw	839-040314
Sems. Round Head Machine Screw	821-040314
Resistor 100K R407	600-020971
Resistor 270K R406	600-021071
Resistor 820K R405	600-021191
Resistor 4.7Meg. R408	600-021371
Capacitor Ceramic .0015μf C402	425-010542
Capacitor .022μf C401	401-020342
Shielded Lead Assembly (Vibrato Chorus Cable - Blue Plug)	011-034752
Shielded Lead Assembly (Percussion Volume Cable - Red Plug)	001-034753
Shielded Cable & Cap assembly (Vibrato Switch Cable)	011-036621
Shielded Cable & Cap Assembly (Reverb Switch Cable)	011-036622

PERCUSSION CABLE ASSEMBLY (PERCUSSION CABLE) 011-036640

CABLE ASSEMBLY (LOWER MANUAL PLUG) 011-036749

CABLE ASSEMBLY (UPPER MANUAL PLUG) 011-036750

LOWER MANUAL ASSEMBLY 119-000045

UPPER MANUAL ASSEMBLY 119-000009

Switch Cover Assembly	060-033397
Top Cover Assembly	060-033405
Key Comb Assembly (12 Keys)	057-045053
Key Comb Assembly (8 Keys)	057-045052
Key & Channel Assembly (Sharp Key)	060-024286
Key & Channel Assembly (One Set of Seven Ivory)	057-042770
Bracket & Channel Assembly	060-033392
Sems. Bind Head Machine Screw	850-000002
Sharp Key - Black	025-032672
Natural Key - Ivory "C"	025-042279
Natural Key - Ivory "D"	025-042280
Natural Key - Ivory "E"	025-042281
Natural Key - Ivory "F"	025-042282
Natural Key - Ivory "G"	025-042283
Natural Key - Ivory "A"	025-042284
Natural Key - Ivory "B"	025-042285
Natural Key - Ivory "CX" (Last Key on Manual)	025-042286
Mounting Bracket Left Hand	060-040192
Mounting Bracket Right Hand	060-040193
Strain Relief	013-034999
Screw (Key Comb)	831-070314
Screw (Top Cover)	925-050314
Screw (Switch Top Cover)	831-070414

GENERATOR & MOTOR ASSEMBLY

Description	Voltage	Frequency	Part No.
Generator & Motor Assembly	120V	60Hz	112-000021
Generator & Motor Assembly	120V	50Hz	112-000022
Generator & Motor Assembly	220V	60Hz	112-000023
Generator & Motor Assembly	220V	50Hz	112-000024
Generator Assembly		60Hz	113-000011
Generator Assembly		50Hz	113-000012
Synchronous Motor	120V	60Hz	021-033801
Synchronous Motor	120V	50Hz	021-033802
Synchronous Motor	220V	60Hz	021-033803
Synchronous Motor	220V	50Hz	021-033804
Motor Capacitor	120V	60Hz	499-033806
Motor Capacitor	120V	60Hz or 120V 50Hz	499-033807
Motor Capacitor	220V	60Hz or 220V 50Hz	499-033805
Generator Cover Assembly			115-000003
Terminal Panel Assembly (AC Panel with GY, BL. YEL.)			006-024326
Motor Mounting Bracket			035-027354
Capacitor Clamp			013-024313
Motor Clamp			013-024427
Motor Coupling Spring			012-029132
Motor Coupler			017-024242
Insulator Strip (AC Panel)			036-024328
Post (For Mounting Cover)			044-031434
Terminal Cover			041-022076
Oval End Cap (Motor Capacitor)			041-024838

PEDAL KEYBOARD & SWITCH ASSEMBLY 116-000010

Description	Quantity	Part No.
Pedal Keyboard Frame Assembly		060-024270
Cover Assembly		046-025208
Cable Assembly		011-024210
Actuator	(13 Used)	045-024198
Extension Spring	(13 Used)	012-020404
Stop Post	(13 Used)	044-020398
Up Stop Felt	(26 Used)	042-020410
Down Stop Felt		042-031898
Terminal Lug		007-015197
Pivot Bracket	(8 Used)	035-036094
Pivot Bracket	(5 Used)	035-036095
Terminal Panel Assembly (Long)		063-036553
Terminal Panel		045-024196
Stationary Contact Assembly	(8 Used)	030-033305
Contact Spring Assembly	(8 Used)	012-033541
Actuator Spring	(8 Used)	012-024199
Eyelet	(24 Used)	999-026552
Terminal Panel Assembly (Short)		063-036554
Terminal Panel		006-024197
For Other Components, Refer to Long Panel Assembly.		
Key Channel Assembly (Long)		057-035978
Key Channel (Long)		041-020402
Long Key (Brown)		025-031666
Guide Felt		042-021255
Eyelet		999-017454
Sems. Bind Head Machine Screw (Mounting Key)		850-100514
Key Channel Assembly (Short)		057-035982
Key Channel (Short)		041-020403
Short Key (Black)		025-031469
Guide Felt		042-021255
Eyelet		999-017454
Sems. Bind Head Machine Screw (Mounting Key)		850-100714

PREAMPLIFIER ASSEMBLY 117-000009 (AO-42)

Chassis Pan Assembly				009-024416
Chassis Housing Assembly				009-024417
Matching Transformer Assembly T201				003-024469
Plug Assembly	3 Pin			011-036632
Plug Assembly	6 Pin (Power)			011-024376
Plug Assembly	6 Pin (percussion Switch)			011-036637
Tube 12AU7				002-012300
Tube 12AX7				002-012301
Tube Shield				010-041481
Set of Capacitors & Resistors (Chassis Mounted)				063-024412
Resistor	270K	R206		600-021071
Resistor	1Meg	R214		600-021211
Resistor	330K	R217		600-021091
Potentiometer	30K	R225		676-000144
Resistor & Capacitor Panel Assembly				063-024414
Terminal Board				006-024407
Resistor	68K	R212,R229		600-040931
Resistor	390Ω	R211		600-020391
Resistor	20K	R233		626-060861
Resistor	2.7K	R235		600-030591
Resistor	3.9Meg	R219		600-021351
Resistor	82Ω	R209		600-020231
Resistor	100Ω	R207		600-020251
Resistor	220Ω	R234		600-020331
Resistor	1K	R208		600-020491
Resistor	1.2K	R231		600-020511
Resistor	3.3K	R205		600-020611
Resistor	4.7K	R210,R215,R216		600-020651
Resistor	15K	R213		600-020771
Resistor	47K	R202,R221,R232		600-020891
Resistor	100K	R220,R223		600-020971
Resistor	150K	R224		600-021011
Resistor	180K		Selected for	600-021031
Resistor	220K	R226	Proper Gain	600-021051
Resistor	270K		at Inspection	600-021071
Resistor	270K	R222		600-021070
Resistor	330K	R218		600-021091
Resistor	470K	R228, R230		600-021131
Resistor	680K	R227		600-021171
Resistor	1Meg	R201		600-021211
Resistor	4.7Meg	R203	Selected at	600-021371
Resistor	5.6Meg		Time of	600-021391
Resistor	120K	R236	Inspection	600-020991
Capacitor	.1 mfd 200V	C215		401-020533
Capacitor	.047 mfd 400V	C204		403-030452
Capacitor	.33 mfd 100V	C210		406-010172
Capacitor	100 mfd 3V	C201, C205, C207		407-010029
Capacitor	39 pf 500V	C203		425-010151
Capacitor	.0047 mfd 100V	C211		413-010042
Capacitor	.01 mfd 100V	C208, C209, C213, C214		413-010072
Capacitor	.02 mfd 100V	C212		425-010763
Capacitor	.1 mfd 10V	C206		427-030025
Transistor		Q201		001-021070

VIBRATO AMPLIFIER ASSEMBLY 126-000023 (AO-47)

Chassis Pan Assembly	009-036649
Chassis Housing Assembly	009-024417

Saturable Reactor Assembly					063-025246
Plug Assembly	3 Pin				011-036630
Plug Assembly	6 Pin				011-024376
Capacitor	30 mfd/350V, 40 mfd/450V, 40 mfd/400V		C109, C110, C111		450-040200
Potentiometer	500K		R131		676-000152
Tube	7247				002-006307
Tube	12AU7				002-012300
Tube Shield					010-041481
Terminal Board Assembly (Resistor & Capacitor)					063-027083
Terminal Board					006-036647
Resistor	5K		R123		603-060761
Resistor	56K		R136		600-030911
Resistor	10K		R103, R107, R113, R114, R118, R109		600-030732
Resistor	470Ω		R106, R112, R117		600-020411
Resistor	560Ω		R133....Use With Red Dot Reactors		600-020431
Resistor	1K		R132		600-020491
Resistor	1.2K		R121		600-020511
Resistor	8.2K		R122		600-020711
Resistor	15K		R104, R110, R115		600-020771
Resistor	47K		R119		600-020891
Resistor	180K		R102		600-021031
Resistor	220K		R101		600-021051
Resistor	330K		R135		600-021091
Resistor	470K		R130, R125, R126, R127		600-021131
Resistor	1Meg		R120, R139, R105, R111, R116		600-021211
Resistor	1.8Meg		R108		600-021271
Resistor	1.2K 5%		R129		600-020512
Resistor	150K 5%		R128		600-021012
Resistor	12K				600-020751
Resistor	15K			One Resistor	600-020771
Resistor	18K		R137	Selected at Factory	600-020791
Resistor	22K			For Proper Phase	600-020811
Resistor	27K			Shift	600-020831
Resistor	33K				600-020851
Resistor	1.2Meg				600-021231
Resistor	1.5Meg			One Resistor	600-021251
Resistor	1.8Meg			Selected at Factory	600-021271
Resistor	2.2Meg		R138	For Proper Vibrato	600-021291
Resistor	2.7Meg			Rate 6.6-7.0 Hz.	600-021311
Resistor	3.3Meg				600-021331
Resistor	3.9Meg				600-021351
Resistor	270Ω				600-020351
Resistor	330Ω			One Resistor	600-020371
Resistor	390Ω		R133	Selected at	600-020391
Resistor	470Ω			Factory For Proper	600-020411
Resistor	560Ω			Width Control	600-020431
Capacitor	.047 mfd	100V	C118		406-010112
Capacitor	.02 mfd	100V	C114, C115		406-010182
Capacitor	.02 mfd	400V	C113		422-032012
Capacitor	.047 mfd	400V	C108		422-032022
Capacitor	.10 mfd	400V	C116		422-032032
Capacitor	.47 mfd	400V	C102, C104, C106		422-032092
Capacitor	150 pf	500V	C120, C121, C122		425-010292
Capacitor	.001 mfd	500V	C101		425-010502
Capacitor	.0018 mfd	500V	C112		425-010562
Capacitor	.01 mfd	500V	C103, C105, C107, C119		425-010752

POWER AMPLIFIER ASSEMBLIES

Power Amplifier Assembly	120V	60Hz		(AO-43-1)	126-000017
Power Amplifier Assembly	120V	50Hz		(AO-43-2)	126-000018
Power Amplifier Assembly	234V	50-60Hz		(AO-43-3)	126-000019
Chassis Pan Assembly					009-024410
Power Transformer Assembly	120V	60Hz		T-302	003-024157
Power Transformer Assembly	120V	50Hz		T-302	003-036548
Power Transformer Assembly	234V	50-60-Hz		T-302	003-036549
Output Transformer Assembly				T-301	003-036550
Filter Choke Assembly	14 Henery			CH-301	003-024159
AC Cord & Plug Assembly					011-033233
AC Strain Relief					013-034998
Plug Assembly	3 Pin Female (Output)				011-036628
Plug Assembly	9 Pin				011-024379
Plug Assembly	3 Pin Female (Reverb)				011-036633
Tube	12BH7	V7			002-012302
Tube	12AX7	V6, V8			002-012301
Tube	6BQ5	V9, V10			002-006700
Tube	5U4	V12			002-005201
Set of Capacitors & Resistors (Chassis Mounted)					063-024401
Resistor	64Ω	R338			604-070071
Resistor	4.7K	R335			600-030651
Resistor	8.2K	R341			600-030711
Resistor	390Ω	R310, R314			600-020391
Resistor	1K	R311, R312			600-020491
Resistor	3.9K	R337			600-020631
Resistor	47K	R313, R323			600-020891
Resistor	470K	R301			600-021131
Resistor	4.7Meg	R318			600-021371
Resistor	220K	R344			600-021051
Resistor	300Ω	R339			602-050081
Resistor	750Ω	R340			602-050121
Resistor	1K	R343			602-050141
Resistor	130Ω	R332			606-050022
Resistor	33K	R309		Factory Selected For Nominal Gain	600-020851
Resistor	39K				600-020871
Resistor	56K				600-020911
Resistor	82K				600-020951
Resistor	120K				600-020991
Resistor	270K				600-021071
Capacitor	100pf	500V	C307		425-010252
Capacitor	.0022 mfd	500V	C315		425-010583
Capacitor	.0012 mfd	500V	C304		425-010522
Capacitor	.02 mfd	500V	C305		425-010763
Capacitor	.001 mfd	2000V	C314		425-030503
Capacitor	50 mfd	450V	C303		450-010070
Capacitor	50 mfd/450V	50 mfd/450V	C316, C317, C318, C319		450-040401
Capacitor	.001 mfd	500V	C320		425-010502
Resistor & Capacitor Panel Assembly					063-024411
Resistor	150Ω	R321			600-020291
Resistor	1K	R333, R334			600-020491
Resistor	2.7K	R302, R327			600-020591
Resistor	6.8K	R322			600-020691
Resistor	10K	R305, R306			600-020731
Resistor	39K	R308			600-020871
Resistor	47K	R325			600-020891
Resistor	68K	R315			600-020931
Resistor	100K	R316, R317, R328, R329			600-020971

Resistor	150K	R320		600-021011
Resistor	180K	R304		600-021031
Resistor	220K	R303, 319		600-021051
Resistor	330K	R307, 330, 331		600-021091
Resistor	470K	R324		600-021131
Resistor	1Meg	R326		600-021211
Capacitor	.047 mfd	400V	C311, 312	403-030452
Capacitor	100 mfd	3V	C301, 308	407-010029
Capacitor	220 pf	500V	C310	425-010332
Capacitor	.02 mfd	500V	C302, 309	425-010763
Capacitor	5 mfd	150V	C306	450-040083
Capacitor	100 mfd	25V	C313	450-040084
Potentiometer	10K	R336		676-000143

SWELL PEDAL ASSEMBLY 123-000021

Base Bracket Assembly	060-030207
Shutter Assembly	060-033749
Bearing Bracket	035-031429
Bearing Bracket with Dowel	035-031428
Pedal Bearing (slotted)	017-031431
Pedal Shaft	020-021725
Machine Screw	843-081113
Lock Washer	999-000729
Square Nut	999-001343
Cell & Housing Wiring Assembly	040-030216
Diffuser	016-030153
Photo Cell Housing Cover	025-032880
Light Bulb Socket Assy.	034-033419
Spring	012-030154
Light Bulb	016-031748
Pedal Assembly (with mat)	060-033289

RHYTHM II & EXTRUSION ASSEMBLY 125-000050

Rhythm II Unit (inbuilt Automatic)	125-000049
Screened Panel (painted Part)	061-042579
R. H. End Cap	045-042507
L. H. End Cap	045-042508

POWER SUPPLY ASSEMBLY 120V 60 Hz. 127-000041

POWER SUPPLY ASSEMBLY 120V 50/60 Hz. 127-000042

POWER SUPPLY ASSEMBLY 220V 50/60 Hz. 127-000043

Power Supply Chassis			041-033662
Terminal Strip Assembly			006-028913
Transformer	120V	60 Hz.	003-033473
Transformer	120/220V	50/60 Hz.	003-033474
Capacitor, Electrolytic	500 mfd/40V		407-090329
Diode		4 used	001-024051
Resistor	1K	3W	602-050141
Resistor	68 Ohms	3W	602-050021

MISCELLANEOUS

Generator Pad	036-024354
Speed Clip	013-024843
Reverberation Unit Assembly	121-000002
Power Supply Cable	011-024357
Terminal Panel Assy. (between Reverb & Amp)	006-034306
Cable & Cap Assy. (Speaker to Amp)	011-036623
Cable & Contact Assy. (between Speakers)	011-036741
Shielded Lead & Plug Assy. (between Preamp & Vib. Amp)	200-010327
Shielded Lead & Plug Assy. (between Preamp & Vib. Amp)	200-010328
Shielded Lead & Plug Assy. (Red Reverb Cable)	011-036643
Shielded Lead & Plug Assy. (gray Reverb Cable)	011-036644
Shield (Rhythm II Power Supply)	010-042054
Speaker 12" (R.H. Viewed from Rear)	014-030812
Speaker 12" (L. H. Viewed from Rear)	014-027293
Cable & Plug Assy. (BLK plug cable at Amp)	011-036388
Terminal Cover (lower manual)	041-024164
Grommet (lower manual)	043-039553
Swell Pedal Housing Assembly	046-025206
Amplifier Base	009-024824
End Block – Lower L.H.	025-028406
End Block Bracket	035-031459
End Block – Lower R. H.	025-028407
Terminal Strip Assembly (Shelf)	006-043833
Generator Tee-Nut	999-032998
Generator Grommet	043-024246
Generator Washer	999-000104
Generator Mounting Screw	824-121114
Plastic Ties	013-031744
Oil Tube Assembly	015-025581
Trim Strip (Swell Pedal)	055-025648
Front Strip (manual)	061-031029
Cable Clip	013-024296
Pedal Filter Choke Assembly	003-025333

WOODWORK

Cabinet Assembly	L-212	111-000115
Case Assembly		050-036895
Rear Cover		056-040228
Fastener		013-040269
Brad		999-040271
Fastener "Clip" (Rear Cover)		013-036811
Baffle & Grille Cloth		052-036887
Lock Nut (Speaker & Baffle Mounting)		999-001437
Baffle (only)		054-025432
Grille Cloth		053-038428
Standard Mounting Screw		999-006116
Plastic Bumper		025-023329
Top & Music Panel Assembly		050-002778
Top Panel		050-000840
Music Panel		050-038295
Hinge		032-033414
Screw		880-030537
Top Rail Screw		832-081814
Stud (Top Panel)		044-042417
Bench Assembly		152-000024

Cabinet Assembly L-222	111-000116
Case Assembly	050-025470
Rear Cover	056-040228
Fastener (Rear Cover)	013-040269
Brad	999-040271
Fastener "Clip" (Rear Cover)	013-036811
Baffle & Grille Cloth	052-036887
Lock Nut (Speaker & Baffle Mounting)	999-001437
Baffle (only)	054-025432
Grille Cloth	053-038428
Standard Mounting Screw	999-006116
Plastic Bumper	025-023329
Top & Music Panel Assembly	050-002807
Top Panel	050-000840
Music Panel	050-025427
Hinge	032-033414
Screw	880-030537
Top Rail Screw	832-081814
Stud (Top Panel)	044-042417
Bench Assembly	152-000027
Cabinet Assembly L-295	111-000125
Case Assembly	050-002100
Rear Cover	056-044430
Fastener (Rear Cover)	013-040269
Brad	999-040271
Fastener "Clip" (Rear Cover)	013-036811
Baffle & Grille Cloth	052-036890
Lock Nut	999-001437
Baffle (only)	054-025432
Grille Cloth	053-032909
Standard Mounting Screw	999-006116
Plastic Bumper	025-023329
Top Panel	050-002134
Music Panel	050-002130
Bench Assembly	152-000008

NOTES

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